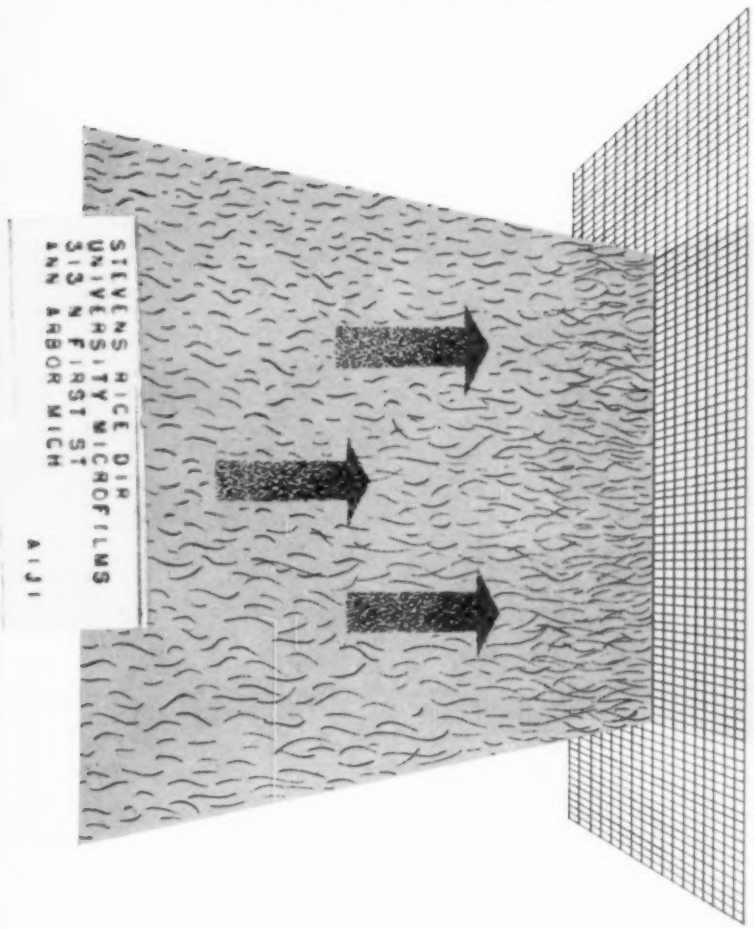
Applied Hydraulics

PNEUMATICS · ELECTRICAL CONTROLS

AUGUST 1958



SPECIAL REPORT

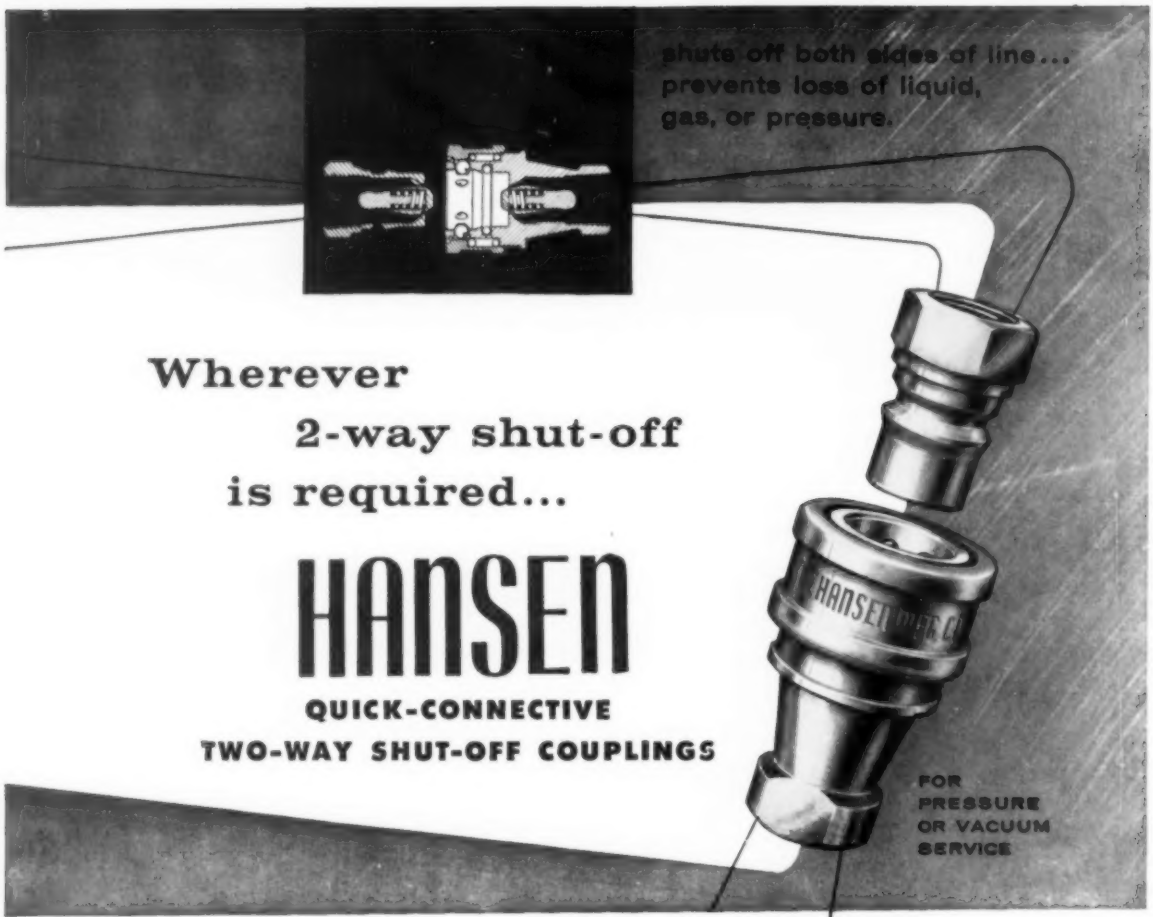
Designing for Fluid Maintenance

see contents page 3

THE MAGAZINE OF FLUID POWER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

Plan Now to Attend the
NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS
October 16-17 Chicago



Wherever 2-way shut-off is required...

HANSEN

QUICK-CONNECTIVE TWO-WAY SHUT-OFF COUPLINGS

FOR PRESSURE OR VACUUM SERVICE

To connect a Hansen Two-Way Shut-Off Coupling, you merely pull back the sleeve and push the Plug into the Socket. To disconnect, just pull back the sleeve. No tools required. When Coupling is disconnected, similar valves in Socket and Plug shut off both ends of line—practically eliminate spilling of liquid or escape of gas at instant of disconnection.

Hansen Series HK Two-Way Shut-Off Couplings are available with female pipe thread connections from ⅛" to 1" inclusive. Available in brass or steel. Sizes generally required for L-P Gas service have approval of Underwriters' Laboratories.

WRITE FOR THE HANSEN CATALOG

Here's an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings—including Special Service Couplings for Steam, Oxygen, Acetylene, etc.

REPRESENTATIVES IN PRINCIPAL CITIES

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CIRCLE 52 ON TIME-SAVER CARD

ANNOUNCING

the cylinder you designed!

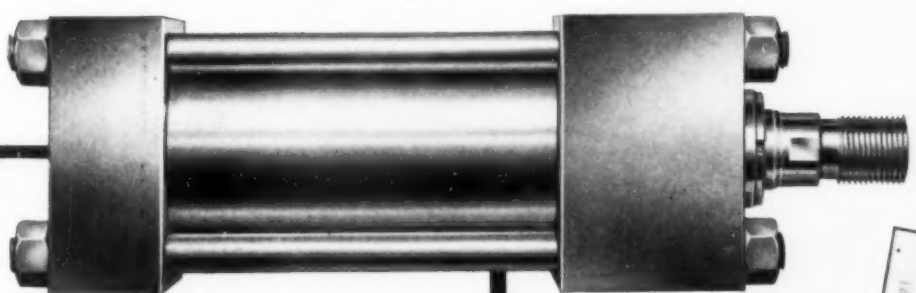
To save you and hundreds of other busy engineers time at the drawing board, Hanna representatives asked what you desired in hydraulic cylinder design.

You wanted a **stronger cylinder, preferably all steel with welded mountings.** You also wanted **tight sealing** at all pressures. These features were included in the Hanna Powrdraulic design. Some wanted **automotive piston rings;** others wanted **synthetic piston packings,** so the new flexible Powrdraulic design gives you a choice. You can also choose the **fast change cartridge gland** or the conventional **multiple lip packing** and you have a **choice of packing material** including Teflon* and silicone rubber.

Hydraulic cylinders should incorporate **industry standard mounting dimensions** and conform to Joint Industry Conference recommendations. These are included in the Powrdraulic design.

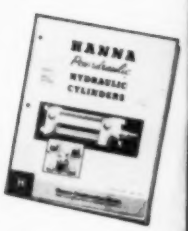
In addition, you want a cylinder that is **priced right,** with **prompt delivery** and **service available** in all parts of the country. You can have all this plus the assurance of quality when you specify Hanna Powrdraulic cylinders.

We will be happy to send you a catalog, and give you the name of your nearest Hanna Representative. You'll also find him listed in the yellow pages under "Cylinders" and in the alphabetical section of Thomas' Register.



Hanna Powrdraulic Hydraulic Cylinder
2000 psi and 3000 psi non shock — with generous factor of safety
Featuring — Pressure tightening tube seals
• One piece steel heads with welded mountings
• Double seal piston rings • Fast change cartridge gland
• Lubricated rod bearing

For full details write for Catalog 900



* Teflon is DuPont's registered trademark for its fluorocarbon resins.

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CIRCLE 51 ON TIME-SAVER CARD

why use the QUAD® RING exclusively?

because it

"... withstands more wear"
"... maintains bubble-tight seal"
"... has high dependability rate"

100% Conversion to Quad Ring

Read the Chemtrol Corporation's explanation for their recent complete conversion from standard O-rings to the exclusive Minnesota Rubber QUAD RING.

CHEMTROL CORPORATION

chemtrol

1417 West El Segundo Blvd.
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NEvada 6-5102

October 18, 1957

Minnesota Rubber & Gasket Company
18633 Ventura Boulevard
Tarzana, California

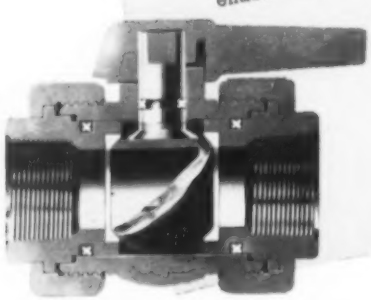
Gentlemen:

We have been utilizing your "Quad" ring design seals in our Micro-Meter Needle Valves, Micro-Flow Globe Valves and our line of Ball Valves in sizes from ¼" to 3" pipe size and have recently replaced all "O" ring seals with your "Quad" ring seals. Our reason for conversion to 100% "Quad" rings was based on many factors. The most important factor is the ability of the "Quad" ring type seals to maintain a bubble-tight seal ranging from high vacuum to our maximum pressures which in tests extend in a range to over 3000 psi. It has been our experience that the "Quad" ring seal, due to its unique contact arrangement, has the ability to withstand more wear with less degradation than any other type of seal such as our standard 150,000 cycle wear test at elevated temperatures which we use to qualify our valve design. A very important factor in our utilization of Minnesota Rubber "Quad" rings is the unusually high dependability rate evidenced in the small amount of reject parts received which pays off in labor costs of replacement of defective seals after production testing.

We wish to further express our appreciation of the fine service extended us by your engineers, both in promptness of supply, engineering assistance and in addition, the cooperation of your laboratory in supplying us with data and special components that enable us to better serve our customers.

Yours very truly,
CHEMTROL CORPORATION

Martin Usab, President



One member of the Minnesota Rubber family is the Research and Development Division. If your company has a problem in rubber, as Chemtrol did, you may find the answer in the excellent research facilities and programs of Minnesota Rubber's Research and Development Division.

16-page facilities brochure available on request. For full information, write:

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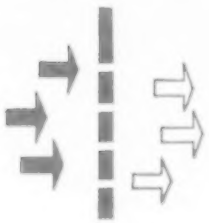
Applied Hydraulics

VOLUME 11/NUMBER 8

AUGUST 1958

THE MAGAZINE OF FLUID POWER



SPECIAL REPORT

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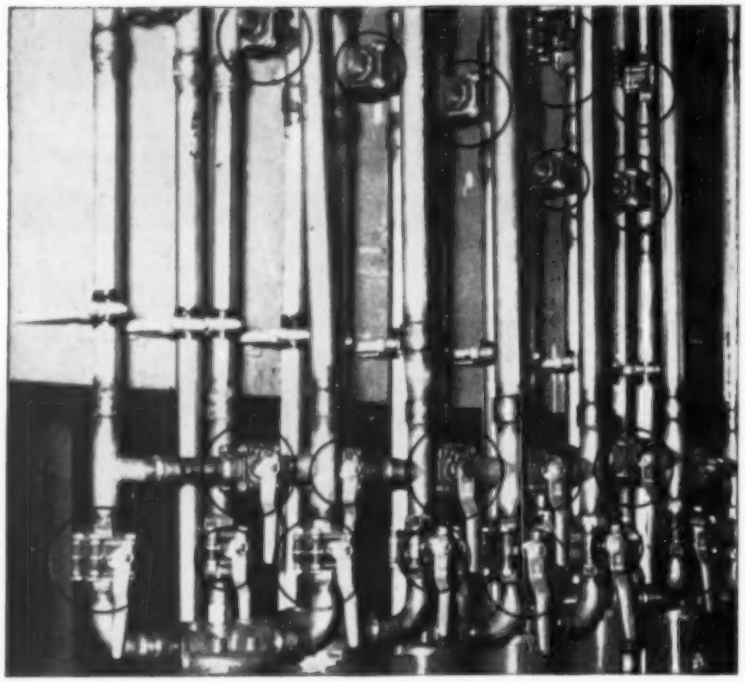
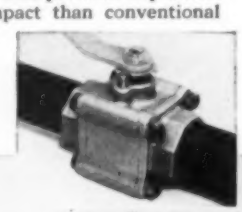


Only the ECON-O-"MISER" Ball Valve was able to solve this problem for PathéColor, Inc.

THE PROBLEM: To find a valve that would meet all of the following requirements:

1. Quick visual indication of position and quarter turn operation. 2. Excellent flow characteristics and positive shut-off. 3. The advantages of flange construction without the bulk and weight of conventional flanged valves. 4. Easy & quick disassembling for low cost maintenance. 5. The most compact and economical installation of Type 316 stainless steel valves possible.

SOLUTION: *Specifying* and *installing* Worcester's Econ-o-"miser" Ball Valve. In so doing PathéColor found a valve that provides a positive seal, a flanged construction much more compact than conventional valves that could be socket welded. In addition many unions and companion flanges were eliminated with the overall result that savings on this installation alone amounted to many hundreds of dollars.



Valves available, ¼"-2", in following standard materials*: Bronze, Aluminum Bronze, Aluminum, Carbon Steel and Types 303 and 316 Stainless Steel. Standard Seat and O-Ring materials*: Buna-N, Neoprene, and Teflon.

**Other materials available on request.*

For further information and descriptive literature write to:

WORCESTER VALVE CO., INC.

16 PARKER STREET • WORCESTER, MASS.

Applied Hydraulics

THE MAGAZINE OF FLUID POWER

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Useful Literature

NEW EDITION OF ANCHOR FLANCO* CATALOG ANNOUNCED

A new edition of the Anchor FLANCO* Catalog, No. 402, has just been released and is now being distributed. The revision was necessitated by the continuous extension and broadening of the Anchor Line of FLANCO* 4-Bolt, Split-Flange Clamps, "O" Ring, Flanged Head Couplings and their accessory fittings.

These FLANCO* couplings are available in either Pressed-On or Reusable Clamp Types. Both styles have a Flanged "O" Ring Head which is used in conjunction with Anchor's patented Split-Flange Clamp Halves. The easily installed Clamp Halves are held in place on valve or pump bosses by four cap screws.

With FLANCO* Couplings the necessity for costly and troublesome pipe threads, gaskets and sealing compounds is eliminated. Connections to bosses can be made without danger of wedging by tapered pipe threads. Hose assemblies or tubing can be disconnected and reconnected time after time without leaks since there are no threads to wear out or tapered seats to groove.

No special tools are required to connect the FLANCO* 4-Bolt, Split-Flange Clamp —just small, automotive type wrenches.

FLANCO* Couplings, either Pressed-On or Reusable, are available as straight couplings and in all standard angles.

Also available, assembled to a 2-Wire Braid Hose, is a Swivel, Pressed-On Coupling, that provides a full 360° swivel so that it is no longer necessary to specify angle offset on hose assemblies. It is available in 45°, 90°, and other standard angles, and in sizes from ½" ID to 2" ID for 2-Wire Braid, High Pressure Hose.

Anchor Patented FLANCO* 4-Bolt, Split-Flange Halves and "O" Ring Flanged Head Couplings can be supplied with the following hose styles and sizes:

Style "C"—2-Wire Braid—½" ID to 2" ID

Style "CC"—Extra Strength 2-Wire Braid —1¼" ID to 2" ID

Style "CHX"—3-Heavy Wire Braid—1" ID to 2" ID

Style "F"—1-Wire Braid—½" ID to 2" ID

HI-BURST*—2-Rayon Braid—½" ID to 1¼" ID

Style "R"—Standard 2-Rayon Braid—½" ID and ¾" ID

Style "SW"—Spiral Wire Suction—¾" ID to 3" ID

FLANCO* connector unit used to connect hose and tubing

For connection of hose to hose, or hose to pipe or tubing, FLANCO* Connector Units are available for ½" ID to 3" ID hose. The connector unit consists of 4 Split-Flange Clamp Halves, a Connector Plate, 4 Fin Hex Bolts and Nuts, and 4 Lock Washers.

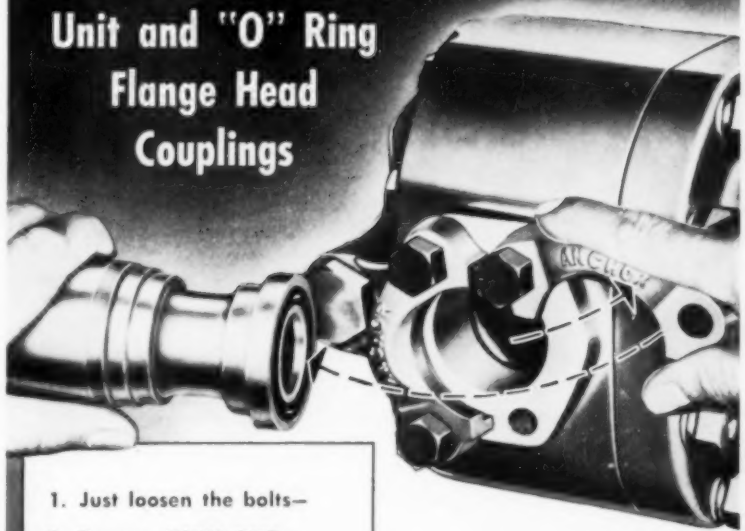
Copies of the new edition of Anchor's FLANCO* Catalog may be obtained by writing Anchor Coupling Co. Inc., 397 No. Fourth St., Libertyville, Ill., and asking for Catalog No. 402.

*T.M. Reg. U.S. Pat. Off.

Easier to Connect or Disconnect!

ANCHOR FLANCO®

SAE 4-Bolt Split-Flange Unit and "O" Ring Flange Head Couplings



1. Just loosen the bolts—
2. Remove ONLY ONE—
3. Pivot the Split-Flange Clamp Half, together with the "O" Ring Flange Head Coupling, around the other bolt—
4. Remove Hose Coupling!

To reconnect, just reverse the procedure.

Try connecting and reconnecting a FLANCO Coupling in close quarters to fully appreciate the convenience of this patented Split-Flange Clamp design!

In addition, with FLANCO couplings you can reduce production costs by eliminating costly pipe threading operations—use more easily handled, small, automotive type wrenches to make up joints —and you eliminate separate union and swivel connections. Hose lines can be disconnected and reconnected many times without leaks, because there are no threads to wear out or tapered seats to groove with FLANCO Split-Flange Halves and "O" Ring Flange Head Couplings.

FLANCO "O" Ring Flange Head Type Couplings are available in Pressed-On, or Reusable Clamp Type, as well as Weld Type Fittings.

Andy Anchor says:

You can get the complete story on FLANCO Split-Flange Halves and "O" Ring Flange Head Type Couplings by writing for Catalog 402.

ANCHOR COUPLING CO. INC.

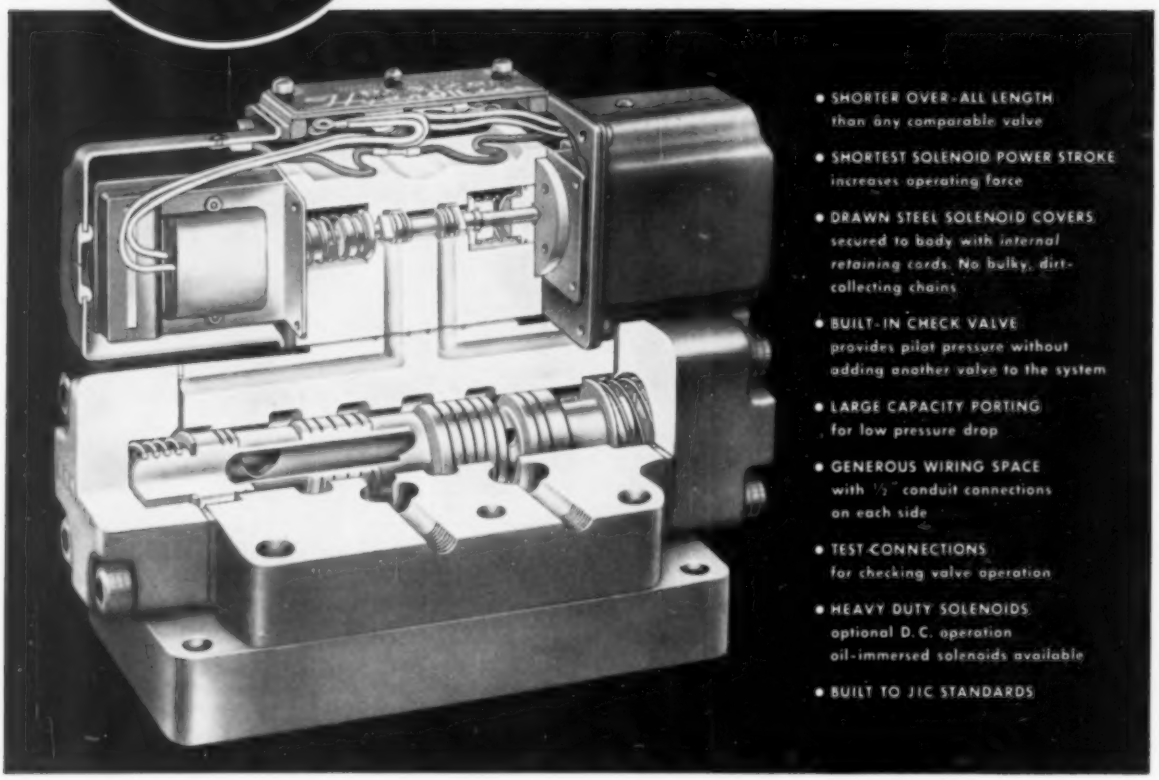
364 No. Fourth Street — Libertyville, Ill.

Branch Offices—Dallas, Texas—Plymouth, Michigan

NEW from DENISON

4-WAY VALVES

Pilot-operated, solenoid-controlled for hydraulic systems up to 5000 psi



- SHORTER OVER-ALL LENGTH than any comparable valve
- SHORTEST SOLENOID POWER STROKE increases operating force
- DRAWN STEEL SOLENOID COVERS secured to body with *internal retaining cords*. No bulky, dirt-collecting chains
- BUILT-IN CHECK VALVE provides pilot pressure without adding another valve to the system
- LARGE CAPACITY PORTING for low pressure drop
- GENEROUS WIRING SPACE with ½" conduit connections on each side
- TEST CONNECTIONS for checking valve operation
- HEAVY DUTY SOLENOIDS optional D.C. operation oil-immersed solenoids available
- BUILT TO JIC STANDARDS

SHOCKLESS HYDRAULIC CONTROL for any directional control requirement is assured with Denison's new line of 4-Way Valves.

Here are *more reasons why* the exceptional design versatility of these new 4-Way Valves is important to Hydraulic Engineers—

1. Provide fast, rapid-cycle directional control of hydraulic flows up to 30 gpm.
2. Operating pressures range up to 5000 psi for both ¼" and ¾" valve sizes.
3. Operate in any porting and positioning combination.
4. Solenoid-operated ¼" valve capacity—5 gpm.
5. Pilot-operated, solenoid-controlled ¾" valve capacity—30 gpm.
6. Choice of spool types and spool positioning provides unlimited combinations for a wide range of applications.
7. Adjustable pilot chokes available for smooth spool reversal.
8. Interchangeable parts simplify service and model changes in the field.
9. Easily modified for operation on internal or external pilot pressure by rotating solenoid valve 180°.

DESIGNERS ENGINEERS!

Send for Bulletins VD-7, VD-8 and 240-B

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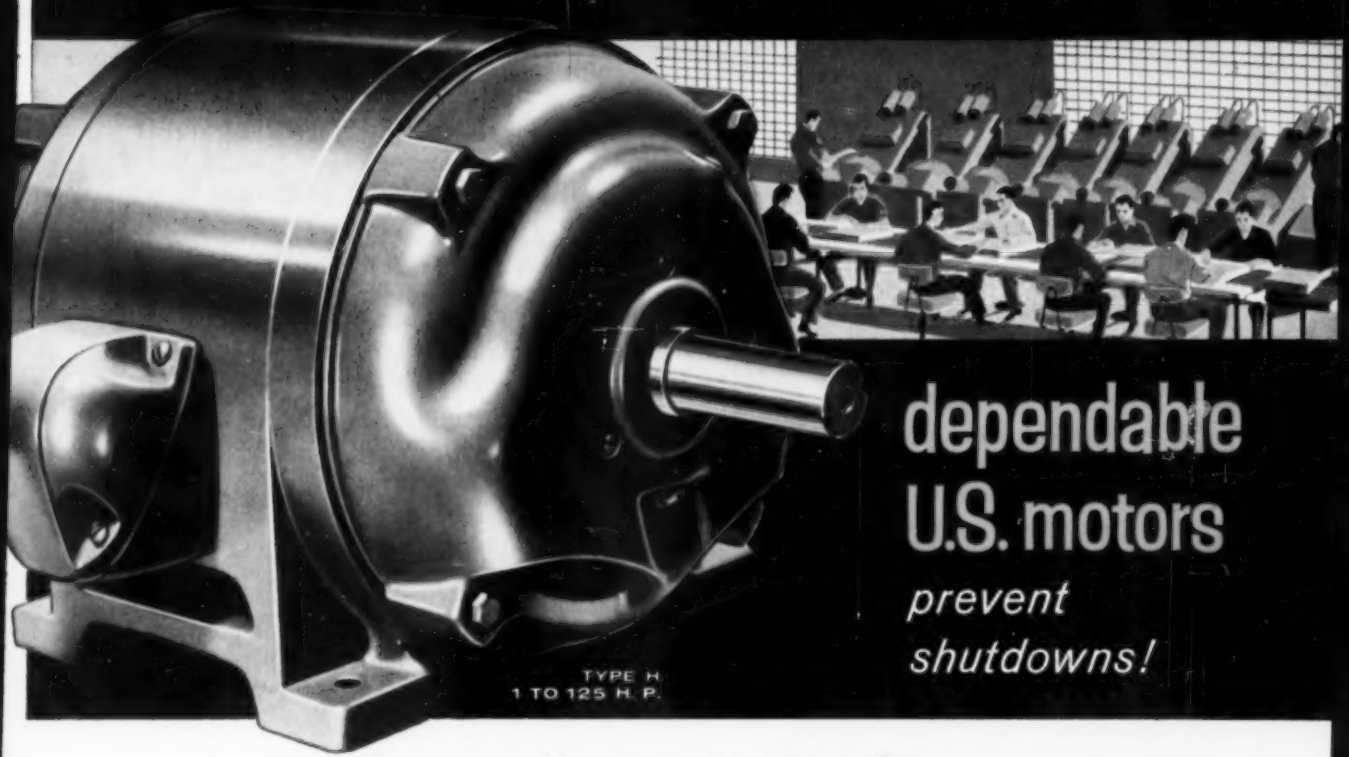
CIRCLE 102 →

production shutdowns **cost more than motors!**



dependable U.S. motors *prevent shutdowns!*

...it pays to specify

U.S. Uniclosed Motors

Because production shutdowns *cost far more than motors,* real economy lies in buying motors of *quality* you can depend on! U.S. UNICLOSED is the motor choice for normal production needs. U.S. UNICLOSED MOTORS give you the quality and dependability that are built into every U.S. motor—plus protection *far* superior to ordinary dripproof motors. Only U.S. protects all windings with nature's non-organic, non-carbonizing insulation—asbestos! This prevents costly burn-outs. Unlike ordinary makes, U.S. motors have shock-resistant, corrosion-resistant cast iron frames that are *normalized*—heat-seasoned to prevent warp! To protect bearings, U.S. LUBRIFLUSH transverse lubrication purges old grease. This minimizes lubrication and maintenance requirements. These and many other factors add up to U.S. *quality*—the kind you can depend upon to keep production lines running! U.S. UNICLOSED 3-phase AC motors are available in RATINGS ¼ to 250 H.P. It pays to specify: "U.S. MOTORS."

U.S. ELECTRICAL MOTORS INC.

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FREE COLOR-ILLUSTRATED BROCHURE
For detailed data on Uniclosed Motors, write for Uniclosed Bulletin No. F-1856

FLUID POWER LINES

about applied hydraulics

20,000 FILTER TRAPS . . . Filter talk jumps out at you wherever you are these days. Slogans everywhere tout their cleaning action. This issue of APPLIED HYDRAULICS is no exception, because it has the theme, *Designing for Fluid Maintenance*, and a large part is devoted to filters. You won't find any slogans here, though, because the filters, lubricators, bleeder valves, reservoirs, and other components described aren't selected because of a slogan. Their design is well analyzed for simplicity, ruggedness, and performance.

To keep you informed about the components that make clean systems, we've surveyed the suppliers for specifications. Read through these round-up articles to learn about the products that will make your machine easy to maintain in the field. This can be just as important a selling point as how many pieces your machine can do an hour.

Designers have got to cooperate with plant men to simplify maintenance on increasingly complex machines. The interviews starting on page 61 give ideas from both sides.

FILTER GLOSSARY . . . Writing a dictionary is more a job for a philosopher than a grammarian, a fellow by the name of Johnson spent a whole lifetime at it. Take a look at the definitions in the Filter Glossary on page 67, see if you agree with them. If not, or if you have more terms, drop us a note.

FILTER ROUND-UP . . . For a 30-minute education on oil filters, air filters and lubricators turn to page 66. Every type is represented there, and the variety shows that no one filter suits all jobs. Each application should be considered "special" to select the filter for best performance.

MECHANICAL LEECH . . . How much thought do you give to selecting a bleeder valve? It can be a very important part of a hydraulic system, especially where fine feed is needed. Pump cavitation can result in some systems when entrained air is not bled off. See the article on page 74 for a survey of bleeder valve designs.

THIS SWISS . . . The name *Professor Hans Thoma* of Zurich is one of the most eminent in fluid power engineering. He's been active in many countries including the U. S. for more than 30 years and is responsible for some of the most basic component designs. On page 80, his son, Dr. Jean Thoma also an outstanding engineer describes a recently developed magnetic filter.

FLYING FILTERS . . . The boys designing airplanes, missiles, rockets, and space vehicles take more pains with their filter installations than industrial people. That's because of the small clearances in their high-performance components. Herbert Howard whose job is designing filters discusses edge and depth types in this month's Aircraft Section.

What! Painting or Etching to Suit the Occasion!

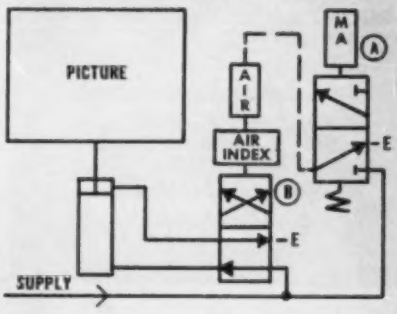
This "one knob picture control" is unlikely we will agree, but . . .

Art tastes do vary. The boys may not wish to share theirs with the spouses . . . in fact they may not *dare* to. And it might even call for a quick disappearing act for the little lady who is wearing little more than a blush. Unlikely as this device is, it would efficiently accomplish this neat scene change for such "art lovers." In the meantime, it gives us a chance to show something new. How one valve can now extend a double acting cylinder, letting it remain extended when the valve is released, then retract the cylinder at the next actuation by using the new Ross momentary air index adaptor.

The Ross air indexing momentary has hundreds of serious uses

Now, a standard Ross Skyline valve, either solenoid or air operated can include this momentary air index adaptor. Then the first actuation will send the valve one way and it will stay in that position, even when the actuator releases. The next stroke reverses the valve, again it stays after actuator release, etc.

See your Ross representative for application information.



SEQUENCE OF OPERATION

1. Valve (A) is manually actuated, valve (B) reverses and stays put, keeping pressure on one side of double-acting cylinder.
2. When Valve (A) is manually actuated again, valve (B) reverses and stays put, keeping pressure on opposite side of double-acting cylinder.

Ross OPERATING VALVE CO.

105 East Golden Gate • Detroit 3, Michigan

CIRCLE 86 ON TIME-SAVER CARD

NATIONAL OIL SEAL LOGBOOK

Ask yourself these questions when specifying oil seals

SHAFT RPM, FPM, RUNOUT, ENDPLAY	Is seal rated at or above my anticipated operating extremes? ☐ YES ☐ NO
TEMPERATURE, LUBRICANT TYPES	Will heat or special-purpose lubricants attack my sealing lip compounds? ☐ YES ☐ NO
PRESENCE OF DIRT OR OTHER FOREIGN MATERIAL	Point often overlooked. If present, should I specify dual-lip sealing member? ☐ YES ☐ NO
COST RELATED TO SEAL DESIGN	Will a simpler, less expensive seal do as good a job as a more sophisticated unit? ☐ YES ☐ NO
NEW SEAL DESIGNS AND MATERIALS ON MARKET	Are there new high temperature, high speed compounds I should examine before specifying? ☐ YES ☐ NO
SPECIAL DESIGNS FOR SPECIAL PROBLEMS	Not all sealing jobs can be met with stock seals. Do I need a special factory design? ☐ YES ☐ NO
DELIVERY, REPUTATION FOR QUALITY	Is my resource noted for on-time delivery, uniform quality, and good follow-up service? ☐ YES ☐ NO

Don't specify "blind." Your National Oil Seal Engineer has up-to-date data on seals—old, new and under development. He understands current sealing parameters; what special designs can probably be developed. His frank, free counsel can't help but lead to better sealing, faster assembly, simpler servicing, faster delivery or lower cost.

Call him today. Number's in the Yellow Pages, under Oil Seals.

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Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
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CIRCLE 72 ON TIME-SAVER CARD

T-J spacemaker cylinder

Quality Engineered

to give quality results

with Extras . . . at No Extra Cost!

You get more—much more—when you specify and use any of T-J's complete line of Spacemaker cylinders. The Spacemaker is engineered to give you better, more accurate, and longer service—offers, exclusively, many extras . . . that are STANDARD, AT NO EXTRA COST!

Designed to eliminate tie-rods, providing greater strength . . . saves space . . . reduces manhours and costs in all push-pull-lift operations. IMMEDIATE SHIPMENT in a wide range of styles and capacities, with 64,000 combinations. Write for Bulletin SM 155-3 with complete engineering details. The Tomkins-Johnson Co., Jackson, Mich.

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METAL PISTON ROD SCRAPER . . . Standard at No Extra Cost!

NEW "SUPER" CUSHION FOR AIR . . . Standard at No Extra Cost!

CHROME PLATED CYLINDER BORES AND PISTON RODS . . . Standard at No Extra Cost!

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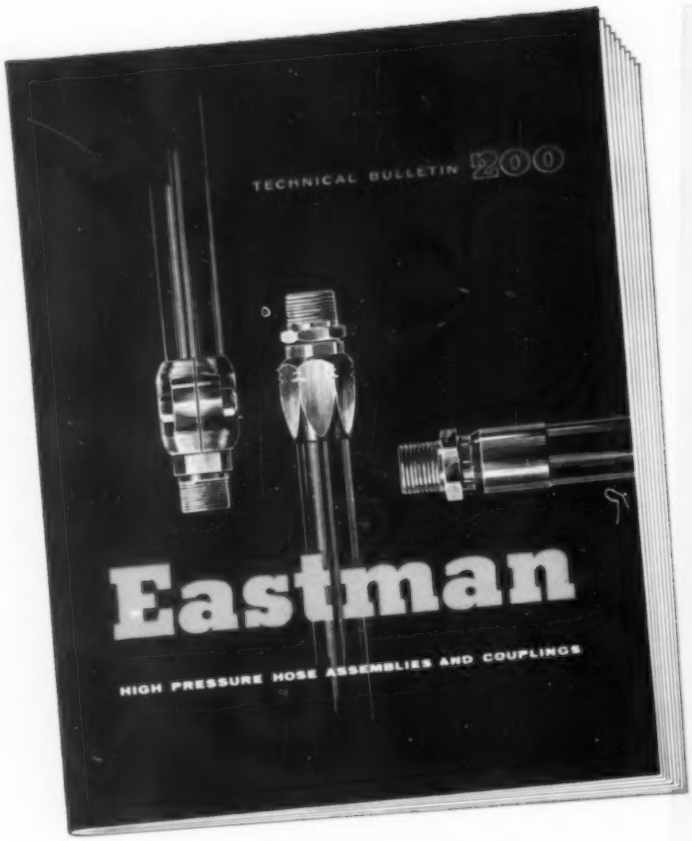
NEW "SELF-ALIGNING" MASTER CUSHION FOR HYDRAULIC USE . . . Standard at No Extra Cost!

NO TIE-RODS TO STRETCH . . . Standard at No Extra Cost!

STREAMLINED DESIGN . . . Oil Pressure to 750 P.S.I.—air to 200 P.S.I. Standard at No Extra Cost!

FORGED SOLID STEEL HEADS . . . Standard at No Extra Cost!

CIRCLE 98 ON TIME-SAVER CARD



CONVENIENTLY ARRANGED TO HELP YOU MEET THE INCREASING DEMAND FOR HIGHER PRESSURES

Here's an entirely new service concept in catalog arrangement. It is designed to assist Engineers and Purchasing Agents in specifying Multi-Braid Hydraulic Hose and Tube Assemblies to meet the demand for increasing pressure requirements. With pressure as a primary consideration—the right assembly can be selected for the specific equipment on which it is to be used.

Nine major sections are devoted to assemblies suited to all types of high pressure hydraulic applications—complete with tables and specifications, including easy to read dimensional cross section drawings.

Include this new catalog in your files to make it easier to specify the proper assemblies.

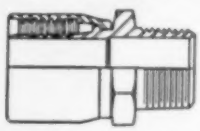
Write for Your Copy Today!

Eastman *first in the field* **MANUFACTURING COMPANY**
Dept. AH-8, MANITOWOC, WISCONSIN

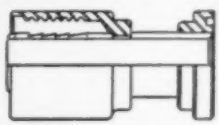
AN INSIDE LOOK AT A *NEW BOOK*

Eastman's new Technical Bulletin offers a new standard in simplified arrangement—for your convenience in specifying—according to your pressure requirements.

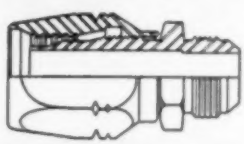
Swivel "O" Ring Male Couplings are available in 45° and 90° angles. Specifications on Page 13.



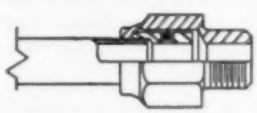
Permanently Attached Couplings for 2-wire braid hose. Specifications and Details on Page 10.



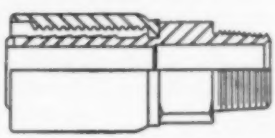
Permanently Attached Flange Head Couplings and Inserts from 0° to 90°. See complete list on Page 21.



2-Piece Reusable Couplings for all high pressure hose. Used for pressures up to 5000 lbs. See Page 25.



Swivel Male Tube Nut "O" Ring Assembly used on formed tubing—described on Page 30.



Permanently Attached Couplings for Extreme High Pressures up to 7000 lbs. working pressure, Page 12.

SAFEGUARDING AMERICA'S LIFELINES OF MOBILE POWER

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

Synchronizing Problem

TO THE EDITOR:

I am in need of a valve, electronic, mechanical or hydraulic type to synchronize the speed of a hydraulic cylinder rod with an electric variable speed drive motor. Is there any method that can be used to control the push stroke of this cylinder to coordinate with the speed of a conveyor driven by this variable drive motor?

I am using a 4 in diameter bore x 49⅜ in stroke hydraulic cylinder to push 3,000 lbs. The return stroke does not have to be taken into consideration for this application can be controlled with any type flow control valve.

ADOLPH F. DAVIT
Project Engineer
Apex Smelting Company
Chicago, Illinois

We can't point to any off-the-shelf item for this design. A lot depends on the degree of accuracy required. We have sent several recommendations and names of companies in your area who can help.

Confusion

TO THE EDITOR:

In the May issue, the circuits and information contained in the article "Seven Ways to Unload a Pump" by Addison T. Smith, were very interesting, but isn't there a valve missing from circuit "B" on the bottom of page 83? Or, is it possibly the wrong schematic circuit? Certainly, the description of the circuit does not fit the schematic.

A. L. HACKER
Baltimore, Md.

Sorry, we created some confusion in Ad Smith's excellent article. The two circuits labeled "B" on page 82 and 83 were transposed. The descriptions are clear if you switch drawings.

Continued on next page

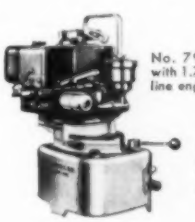
Up to 10,000 psi,
6,000 psi continuous

No. 798-AC Power Pump with ¾-hp, 115-230-volt a-c electric motor

TWO SPEEDS FOR FAST RAM APPROACH!

GREENLEE NO. 798 Portable Power Pumps eliminate nearly all the time loss accumulating while operators of hydraulic devices wait for the ram to contact the work! If you specify pumps for hydraulic rams, jacks, presses, or other systems, be sure to learn the details of this *exclusive* advantage and numerous other advance features of GREENLEE No. 798 Power Pumps capable of developing continuous pressure of 6,000 psi and up to 10,000 psi intermittent pressure. Delivery rate at 1,000 psi, 36 cubic inches per minute; at 10,000 psi, 28 cubic inches. Available with 115-230-volt a-c or 115-volt ac-dc motor; also with gasoline engine. All deliver fast dependable hydraulic power with superior efficiency.

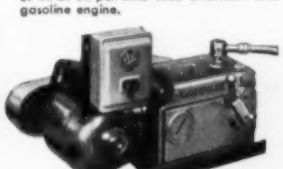
Fast hydraulic return of ram is available in every type GREENLEE Power Pump! All pumps available for *either* single-action or two-way-action rams.



No. 798-GM—with 1.7-hp gasoline engine

No. 798-CO—with ½-hp, 115-volt ac-dc universal electric motor

No. 797-E—with choice of 2-hp or 3-hp a-c electric motor, delivering 106 or 213 cu in. of oil per min. Also available with gasoline engine.



TOOLS FOR CRAFTSMEN
GREENLEE

WRITE, or simply attach this page to your letterhead, for illustrated data sheets giving applications, features, and specifications of GREENLEE No. 798 Pumps.

GREENLEE TOOL CO., 2448 HERBERT AVE., ROCKFORD, ILLINOIS, U.S.A.

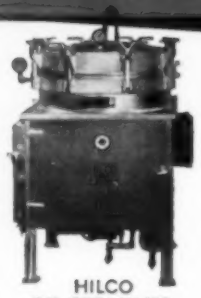
CIRCLE 48 ON TIME-SAVER CARD

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.



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OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

WRITE TODAY FOR THIS *Free* BOOKLET

Recommendations at no Obligation

THE HILLIARD Corporation

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IN CANADA: [illegible]

CIRCLE 55 ON TIME-SAVER CARD

LETTERS

More on D.W.

TO THE EDITOR:

Distilled writing resembles distilled water; lacks sparkle when consumed.

Long live Elmer F. Heiser!

E. HOLDSWORTH
Bramley, leeds,
Yorks, England

P.S. Don't distill the above, brew it!

We can't win 'em all, Mr. Holdsworth. However, we hope to be able to distill our writing and retain the sparkle. And Elmer Heiser is back. He's doing a series of articles on cylinders based on material from his book: "Air and Oil Cylinders for Industrial Applications". For many enjoyable evenings with Heiser order a copy of his book from us. Price is $5.00.

Swivel Fittings

TO THE EDITOR:

Having been connected with the manufacture, sale and installation of hose and tube fittings over the last thirty-five years, the front cover of APPLIED HYDRAULICS June, 1958 "Which Hose Fittings?" immediately attracted my attention. I promptly turned to page 68, read the article by Mr. Taborek, and carefully studied the illustrations.

During World War I, I was a member of a committee to standardize the nomenclature of automobile and truck parts. I have been somewhat of a nut on nomenclature ever since. I am critical of the word "swivel" used in the article on hose fittings. There is not a single "swivel" connection illustrated; therefore, this word should not have been used.

To my knowledge, there are only four types of hose, pipe or tubing connections or connectors: screwed, union, flanged, and welded. Your article illustrates the first three. The fitting types which you call "swivel" are strictly "union".

A "swivel" is a device which

Continued on page 16

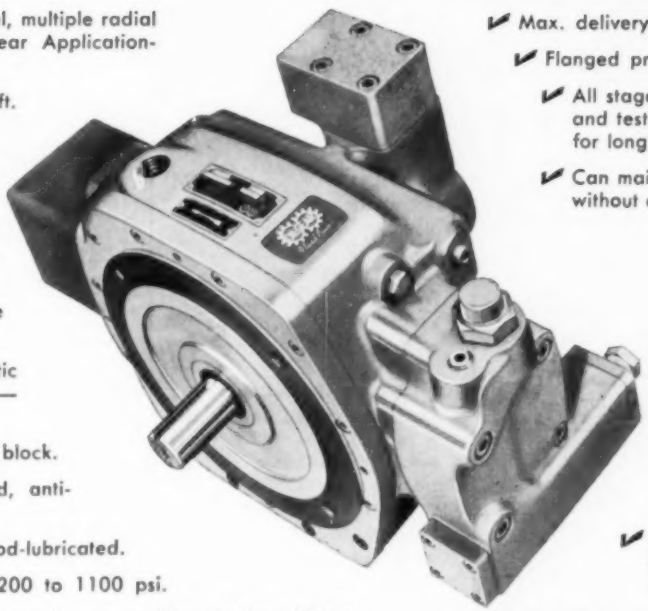
. . . Fluid Power news

NEW RADIAL PISTON VARIABLE DISPLACEMENT PUMP

OILGEAR ANNOUNCES NEW "Power-Saver" PUMPS

New Type "ANP" Pumps Generate Only Needed Power — Boost System Efficiency

- Simple, one piece, alloy steel, multiple radial rolling pistons — an Oilgear Application-Proved, exclusive design.
- One-piece cylinder and shaft.
- Balanced flat valve (port plate) and separate wear plate to assure a controlled oil film between working surfaces . . . high volumetric efficiency over entire pressure range.
- Integral, adjustable volume control.
- Integral, adjustable, automatic pressure unloading control — 200 to 1100 psi.
- Precision, bearing-type slide block.
- Large, conservatively loaded, anti-friction bearings.
- Completely pressure and flood-lubricated.
- Working pressure range — 200 to 1100 psi.



- Max. delivery to 3100 cipm (13½ gpm).
- Flanged pressure and suction ports.
- All stages of manufacturing, assembly and testing under strict quality control for long, dependable service life.
- Can maintain a static load indefinitely without overload or excessive heating.
- Adjust pump volume to suit optimum ram speed — no excess oil to "wire-draw," blow past a relief valve or generate heat.
- Adjust pressure to maximum force needed. When this preset pressure is reached, control automatically reduces pump to slip stroke to save power — reduce heat.
- Available clockwise or counterclockwise rotation at no extra cost.

- Built for continuous, full-load service on pushing, pulling, lifting, lowering applications . . . on machines requiring positive, static loads over intermittent or long periods . . . for automatic charging of accumulator systems . . . for repetitive "ON-OFF" loads up to 1100 psi. New Oilgear type "ANP" pumps will perform more efficiently — with less heat generation — on presses, machine tools, transfer machines, hold-downs, injection molding, die casting — and other machines.

For complete data on these new "Power-Saver"—Oilgear type "ANP" Pumps — call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, requesting your copy of Bulletin 47550 — stating your specific requirements directly to . . .

SELECTION OF MOUNTINGS

Pump case has an accurately finished round face for:

1. Mounting direct to machine. (above)
2. Mounting to a right-angle bracket for "foot-mounting." (right)
3. Mounting to a round adapter for NEMA type "C" electric motor frames.
4. As Standard and "Custom-Built" "Power-Paks"—(right) . . . . complete, compact sources of Fluid Power. Standard "Pak" consists of "ANP" Pump with round adapter or right-angle bracket, coupling, electric motor, 23-gallon differential capacity welded steel base, piping, air breather, filling strainer, fluid level gauges, baffles, clean-out covers, drain plugs, auxiliary pipe connections, and mounting and leveling lugs.

Oilgear's *"Power-Saver"* Pumps and simplified circuitry reduces engineering, production and assembly costs . . . promotes safety, improves performance and system efficiency.

THE OILGEAR COMPANY

Application-Engineered Controlled Motion Systems

1564 WEST PIERCE STREET MILWAUKEE 4, WISCONSIN

What do you look for in a HYDRAULIC BOOST PUMP?

Air-driven pump cycles automatically to produce continuous fluid flow. Eight standard models of various ratios give fluid output pressures from 100 to 30,000 psi. Special models for pressures to 50,000 psi. Applicable wherever low-volume output at high pressures is required, such as static testing, powering presses for forming, clamping, shearing, etc. Originally designed in 1947 for use on Sprague Test Machines. Thousands in use throughout the world.

WRITE TODAY FOR 12-PAGE ENGINEERING BULLETIN

Only Sprague offers all of these advantages:

SIMPLICITY
Simplicity of construction. Fewer moving parts. No cumbersome, high-friction packings. Only two moving "O" rings.

SMALL SIZE
We have it. Measures only 8¼" wide x 9⅝" deep.

FLEXIBILITY
Mounts in any convenient place and in any position.

LIGHT WEIGHT
Weighs only 17 lbs. Easily adaptable to portable packages.

MINIMUM POWER
Uses power only when flow is required. Maintains pressure as needed.

CONTROL-ABILITY
Pressures to 30,000 psi easily controlled by input air pressure.

ECONOMICAL
Low first cost. Minimum of maintenance expense.

COMPLETE POWER PACKAGES

Model S-216-CR is supplied with oil reservoir and controls. Special models available for water or other corrosive liquids.

Model S-440 measures 12" x 12" x 24". Weighs 45 lbs. Contains all necessary equipment for immediate operation at any place convenient to air supply.

SPRAGUE *Engineering Corporation*

19300 So. Vermont Ave., Gardena, Calif. • FAculty 1-1411—DAvis 4-6677

LETTERS

swings, turns, revolves or rotates in use after installation.

H. H. BARROWS
President
Industrial Equipment Co.
Detroit, Mich.

Fortunately, unlike many nomenclature problems, there's a happy solution to this one. A fitting which can swivel or rotate only before installation should be called a "swivel union". Many manufacturers of these fittings use the term "swivel union" in their catalog. Others, including SAE Handbook and ourselves prefer "swivel fittings". The kind that swivel or rotate after assembly are not fittings—they are joints. And so the battle goes.

Miss Phosphate Ester of 1958

TO THE EDITOR:

I found a poem on my desk which I thought you might enjoy. I don't think that the meter is strictly accurate, but it sure bears on fluid power. The poetess is our secretary.

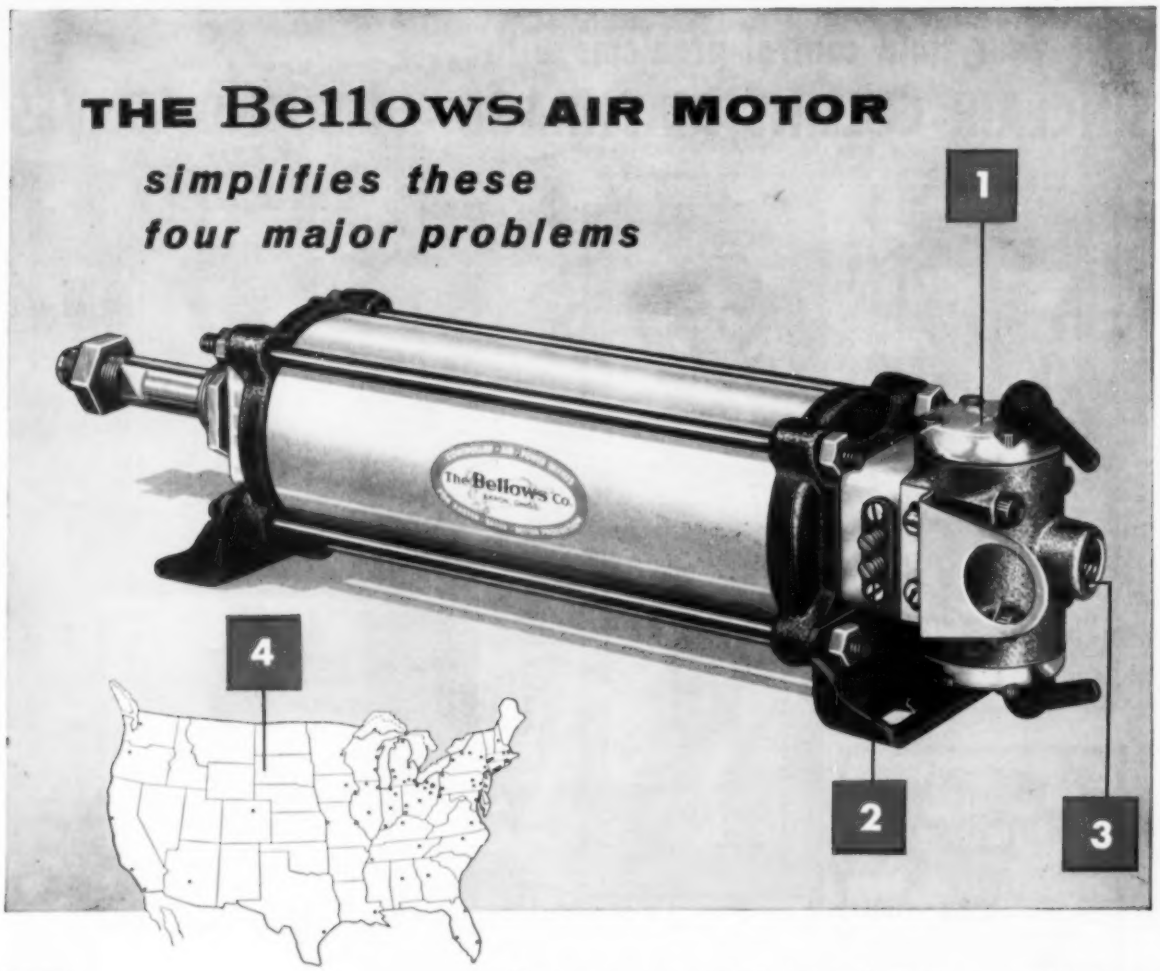
Z. J. LANSKY
Chief Engineer
Hannifin Company
Des Plaines, Ill.

A year ago who thought I'd know
what cylinders and valves are.
A dope was I; for P.S.I.
I thought might be a sports car.
There's Neoprene and Isoprene
and Polyacrylates on
My mind, while Tetrafluoroethylene
I recognize as Teflon.
Phosphate Ester's not a girl
And *heads* aren't always thinking.
My math became a steady tool
while ballet terms went sinking.
I often got a headache
reading Friday's notes on Monday;
but when you state, "You're doing great,"
I want to work on Sunday.
The weather's fine; the people kind,
I'll tell you face to face,
I won't draw lots, for what I've got's,
"The best job in the place."

PHYLLIS PIHL

THE Bellows AIR MOTOR

simplifies these four major problems



1 **Built-in electrically controlled directional valve, either 8 or 110 v., simplifies design problems.**

2 **Built-in speed controls for accurate regulation of piston rod speed simplify control problems.**

3 **The single air connection, which can be made with flexible air hose, simplifies installation problems.**

4 **More than 125 Bellows Field Engineers in the United States and Canada simplify service problems.**

Design, control, installation and service are problems every O.E.M. Design Engineer faces when selecting components for automation.

In pneumatic design, the Bellows Air Motor—the air cylinder with the built-in valve—simplifies his problems. Instead of separate valving for directional control, separate valving for speed control, multiple mounting, complex and cumbersome piping for air supply—he works with one compact, complete power unit.

Not only are design and control simplified when you specify "Bellows", but installation costs are less; and you know wherever your machine is shipped, a Bellows Field Engineer will be available for service if it is ever needed.

Write for Bulletin BM-25
"The Story of The Bellows Air Motor"
Address: Dept. AH-858
The Bellows Co., Akron 9, Ohio

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

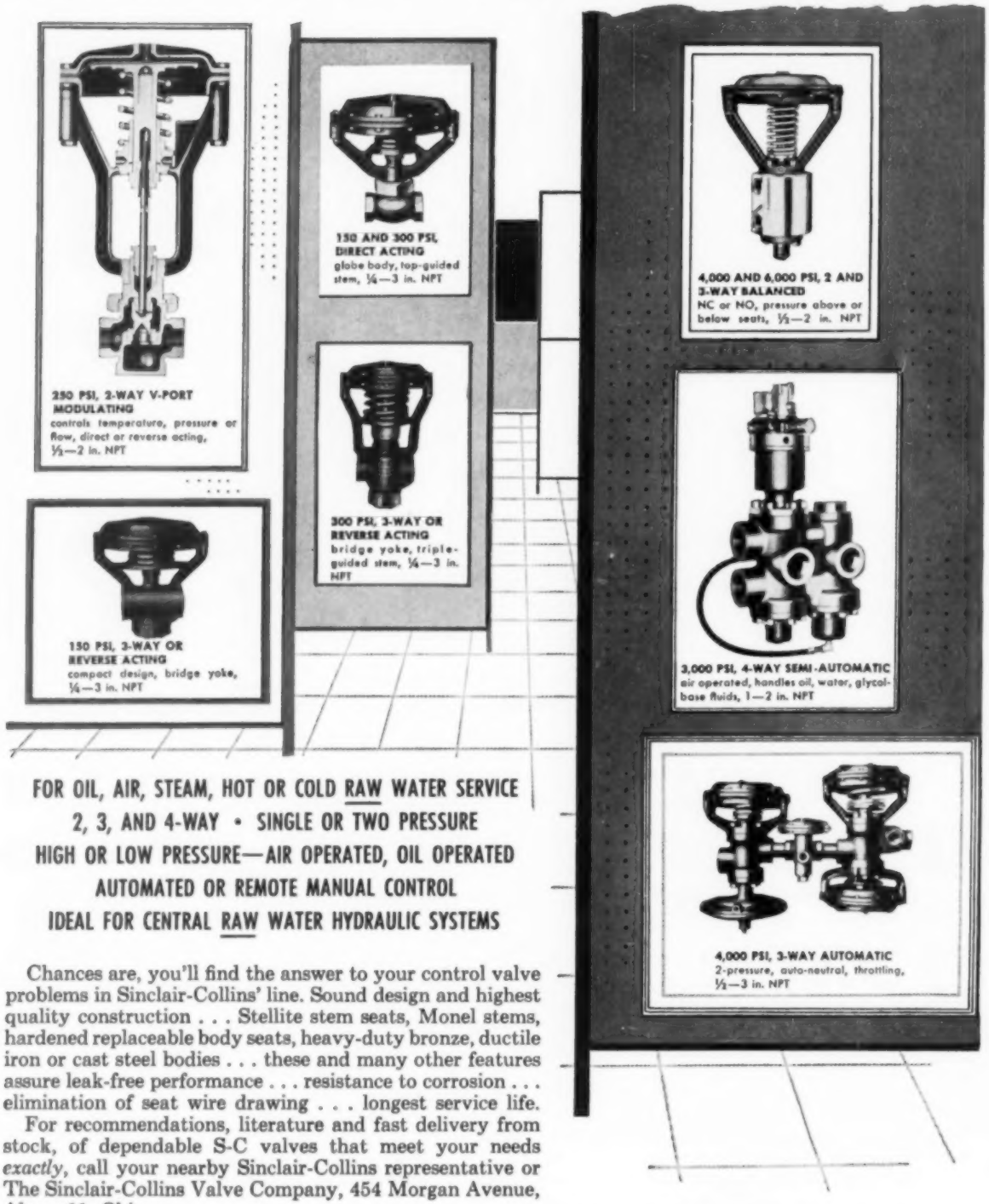
AKRON 9, OHIO

6448

In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ont.

Solve your fluid control problems with...

SINCLAIR-COLLINS DIAPHRAGM-OPERATED VALVES


250 PSI, 2-WAY V-PORT MODULATING
controls temperature, pressure or flow, direct or reverse acting, ½—2 in. NPT
150 AND 300 PSI, DIRECT ACTING
globe body, top-guided stem, ¼—3 in. NPT
300 PSI, 3-WAY OR REVERSE ACTING
bridge yoke, triple-guided stem, ¼—3 in. NPT
150 PSI, 3-WAY OR REVERSE ACTING
compact design, bridge yoke, ¼—3 in. NPT
4,000 AND 6,000 PSI, 2 AND 3-WAY BALANCED
NC or NO, pressure above or below seats, ½—2 in. NPT
3,000 PSI, 4-WAY SEMI-AUTOMATIC
air operated, handles oil, water, glycol-base fluids, 1—2 in. NPT
4,000 PSI, 3-WAY AUTOMATIC
2-pressure, auto-neutral, throttling, ½—3 in. NPT

FOR OIL, AIR, STEAM, HOT OR COLD RAW WATER SERVICE
2, 3, AND 4-WAY • SINGLE OR TWO PRESSURE
HIGH OR LOW PRESSURE—AIR OPERATED, OIL OPERATED
AUTOMATED OR REMOTE MANUAL CONTROL
IDEAL FOR CENTRAL RAW WATER HYDRAULIC SYSTEMS

Chances are, you'll find the answer to your control valve problems in Sinclair-Collins' line. Sound design and highest quality construction . . . Stellite stem seats, Monel stems, hardened replaceable body seats, heavy-duty bronze, ductile iron or cast steel bodies . . . these and many other features assure leak-free performance . . . resistance to corrosion . . . elimination of seat wire drawing . . . longest service life.

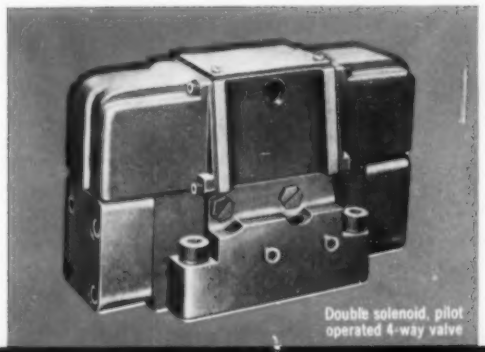
For recommendations, literature and fast delivery from stock, of dependable S-C valves that meet your needs *exactly*, call your nearby Sinclair-Collins representative or The Sinclair-Collins Valve Company, 454 Morgan Avenue, Akron 11, Ohio.

AA-8187

Representatives in principal cities

THE SINCLAIR-COLLINS VALVE COMPANY

454 Morgan Avenue • Akron 11, Ohio



Double solenoid, pilot operated 4-way valve

Double A

Get a custom-built hydraulic circuit without custom priced valves, by using Double A, the most extensive line available. Double A has the widest selection of standard-specification valves anywhere, with almost a third again as many from which to choose. They are made for pressures up to 5000 psi, and are supplied with sub-plate (J.I.C.) mountings, flanges, or threaded connections. If there's a standard hydraulic valve made that fits your requirements, it's more than likely marked "Double A". Write for the Double A catalog.

Now, these famous hydraulic

GEROTOR

Gerotor hydraulic pumps easily claim superiority as the most rugged, most efficient, most dependable pumps available. They last longer, especially with low-lubricity, non-flammable fluids. This is because of their unique Gerotor mechanism. Both Gerotor elements revolve in the same direction, at low relative speed (only one revolution at point of contact for every seven to nine shaft revolutions). Delivery from .42 to 43 gpm, pressures to 2000 psi.

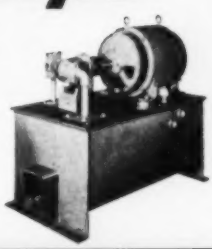
Model QDH, base mounted 2000 psi, 12 gpm pump

valves, pumps & power units

No. 557, herringbone geared 37.6 gpm hydraulic pump

Brown & Sharpe

Brown & Sharpe pumps, for handling machine-tool coolant, lubrication oils, and hydraulic fluids, have through the years become industry's standard line.



Double A hydraulic power units are completely pre-engineered. Don't worry about specifying or assembling components. Just select the standard unit that delivers what you require.

all come from:

Hydraulic equipment buyers everywhere will benefit from the exciting changes at Double A. Now a subsidiary of Brown & Sharpe, world renowned for the manufacture of precision machines and tools, Double A is producing Gerotor pumps and motors, and a new line of standard hydraulic power units, as well as the familiar Double A valves. For more information, write: Double A Products Co., Manchester, Mich.

For precision hydraulic components and assemblies it's

Double A

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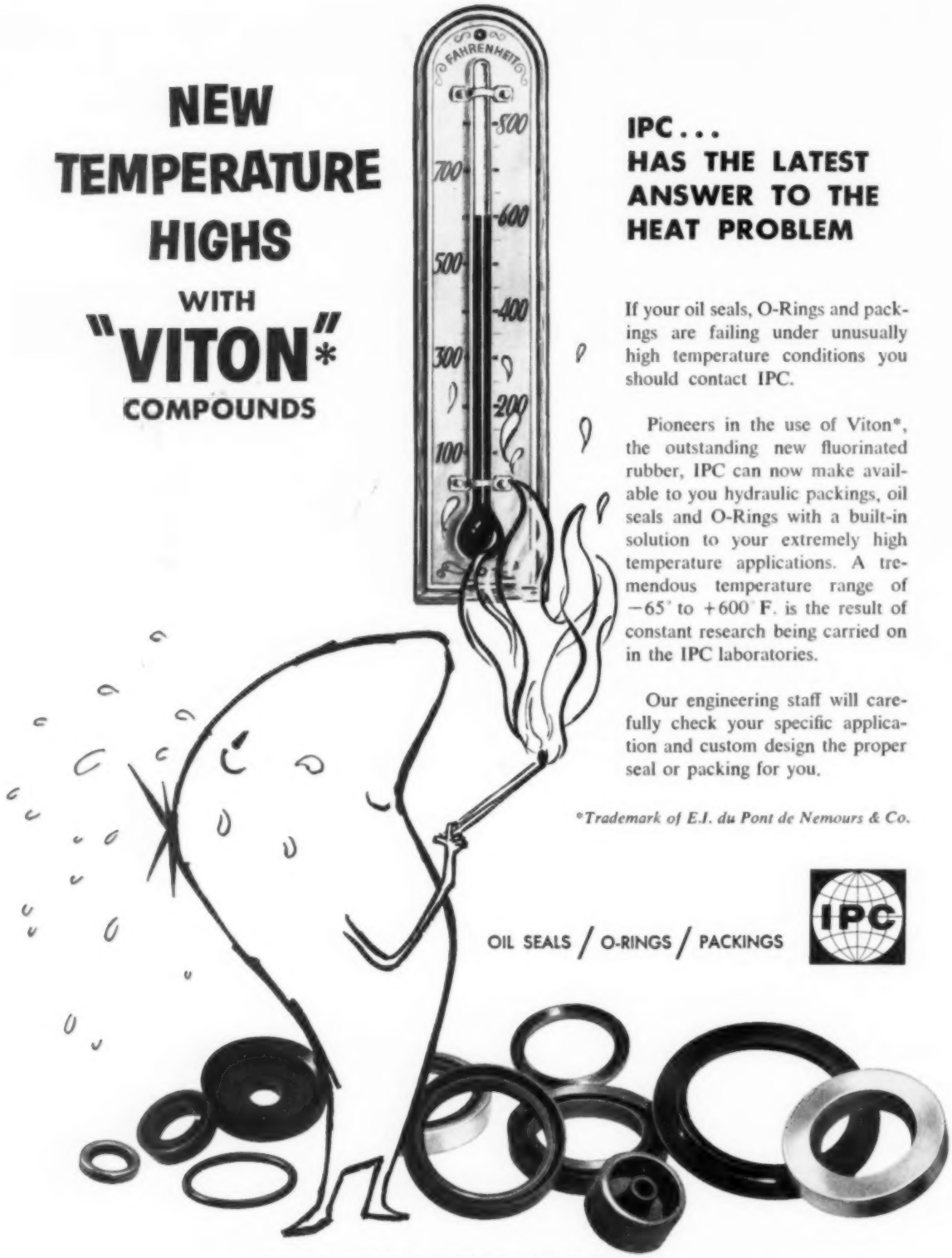
NEW TEMPERATURE HIGHS WITH "VITON"* COMPOUNDS



IPC . . . HAS THE LATEST ANSWER TO THE HEAT PROBLEM

If your oil seals, O-Rings and packings are failing under unusually high temperature conditions you should contact IPC.

Pioneers in the use of Viton*, the outstanding new fluorinated rubber, IPC can now make available to you hydraulic packings, oil seals and O-Rings with a built-in solution to your extremely high temperature applications. A tremendous temperature range of −65° to +600° F. is the result of constant research being carried on in the IPC laboratories.

Our engineering staff will carefully check your specific application and custom design the proper seal or packing for you.

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This car testing machine is operated by Keelavite hydraulics. It is installed at the Rootes Group Ryton factory.

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We at Keelavite are a team of experts in the design, installation and maintenance of complete hydraulic systems. We are ready to accept full responsibility for the proper working of all our installations, including all electrical or other control equipment.

Not only this, we are the manufacturers of the largest range of hydraulic units in the United Kingdom.

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RETAINING RING MAINTENANCE KIT

replace most retaining rings . . . quickly, easily!

- 376 Cadmium Plated Truarc Rings
- Shaft sizes from 1/4″ to 2-1/2″
- Three Most Used Truarc Series of External, Internal, Universal Crescent

Sizes and designs in the kit represent approximately 70% of the retaining ring sizes now being used in industrial, automotive, aircraft and marine applications.

All rings meet the National Aircraft Standard, NAS 669 and NAS 670. The cadmium plating insures you that all rings will have long life in the kit or installed in your equipment.

Complete interchange information is supplied as an integral part of every kit.

Retaining Ring Kits at $34.50 each. (Value of Retaining Rings if purchased separately $46.)

UNIVERSAL

SELECT "O" RING KIT No. 2

Fills Replacement Needs on 85% of All Industrial Equipment

No hunting for Needed Sizes! Efficient, patented and shock resistant plastic case shows at a glance the sizes of "O" Rings in the Kit. Each peg is accurately sized and no other size ring will fit that peg. Interchange information of all leading producers of "O" Rings supplied with each Kit.

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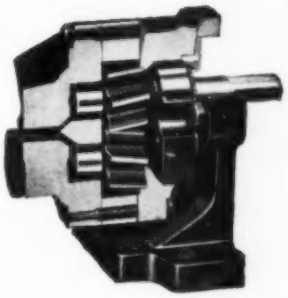

H-107

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CIRCLE 110 ON TIME-SAVER CARD

BRIEFS

about fluid power

PROGRESS IS KEYNOTE OF NFPA'S 5TH ANNUAL MEETING

BEDFORD SPRINGS, PA.—Since its founding in 1953, the National Fluid Power Association has grown from 34 to 66 member companies who are manufacturers of hydraulic and pneumatic components. The association is organized to cover three broad areas of interest: management, marketing and technical.

• **Record of accomplishment**—Two meetings, each for three full days have been held each year. Dozens of committee meetings have taken place between these association meetings. The most tangible accomplishment has been in the area of government relations. This activity has been headed by Roy R. Stevens of Westinghouse Air Brake and David Fromson of Greer Hydraulics. The association has been the major factor in gaining government recognition as an industry for manufacturers of fluid power products. This recognition resulted in the formation of a Fluid Power Advisory Committee to the Business Defense Services Administration of the U. S. Department of Commerce. This committee represents the entire Fluid Power industry. Twelve of its sixteen members belong to NFPA.

New president in action. J. A. Marsh, Rivett Inc. will head NFPA during the coming year. He takes over from Ray Murphy, Sundstrand Machine, who is at his left. To Marsh's right is Lynn Charlson, Char-Lynn Co., who was elected 1st vice-president.

Roy Stevens, Westinghouse Air Brake, reports on Government Relations. To his left is David Fromson of Greer Hydraulics.

• **Legal Affairs**—Much valuable information on legal aspects has been provided to NFPA members. One example is the discussion at the recent meeting relating to proprietary rights. Companies bidding for government contracts face this problem: Winning a government contract can require giving the government all drawings and know-how to be given to competitors when contract comes up for bid again.

David Fromson discussed the value of a dual system of drawings. One set describes the product without telling how to make it. The other set gives full information. Fromson said a new ruling allows the manufacturer to negotiate for extra compensation if release of the second set of drawings is required.

• **Education**—One of the purposes of NFPA has been to promote greater knowledge of fluid power. To do this, several publications have been prepared and distributed. One booklet, widely circulated in high schools, tells of Fluid Power use throughout industry. Another publication, an extensive loose-leaf bibliography, details literature covering hydraulic and pneumatic subjects. A glossary of terms and a booklet on fire-resistant fluids has also been released.

Continued on page 26

Now you can get standard sizes in C/R End Face Seals!

Chicago Rawhide now announces the availability of a complete new line of Standard End Face Seals to meet the widest possible range of sealing requirements. For sizes or conditions beyond the range of Standard End Face Seals, C/R engineers will continue to cooperate with you on special designs. Their experience in sealing applications is unmatched — your assurance of getting the correct seal for the job.

Write for your free copy of this new C/R Bulletin ⟶

Bulletin EF-100 includes complete envelope space data on C/R Standard End Face Seals and mating rings to help you select the correct size for your equipment design:

- Size range table in two series — long and short — from ¾ to 4 inch shaft diameter.
- Size range table on mating rings.
- Typical seal installations for internal and external pressure.
- Special instructions on how to order.

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END FACE SEALS
maximum sealing efficiency in minimum space
• ¾ to 4 inch shaft sizes
• pressures to 500 psi.
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C/R PRODUCTS: C/R Shaft and End Face Seals • Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-Metallic Gears

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Precision chemists have developed more than 400 "O" Ring compounds for industry. One of these is **the right one** for your product. It is **the one** which (1) seals the fluid or gas without loss of vitality, (2) has low compression set, correct tensile properties and severe aging resistance and (3) is properly engineered for your product. Precision can supply you with the **right** "O" Ring produced by manufacturing techniques which assure highest quality. The **right** "O" Ring will **save** you money because it will cost **less** per hour of service life.

A Precision Sales Engineer can help you obtain the **right** product design, then recommend the **right** "O" Ring for your job. Write, phone or wire for his services today.

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BRIEFS

Jack Ellis, chairman of the education committee, reported that the current project is a tabulation of fluid power courses being offered by schools throughout the country.

At the Spring meeting, John Goldring, president of Modernair Corporation showed a 28 slide presentation developed as a basic introduction to fluid power and its place in industry. These slides are available to schools and engineering organizations.

• **Marketing**—Over the years the association has conducted surveys among its members to provide information on distribution and marketing characteristics. Bob Peterman of Galland-Henning reported on costs and members' opinions about trade shows.

The survey being planned by BDSA to determine value of shipments by fluid power component manufacturers will give impetus to one of the association's projects: To determine the market and its annual changes.

• **Technical**—Work is being carried on to develop a Fluid Power language. The goal is to prepare a comprehensive glossary to be submitted to ASA for approval. Dimensional identification for cylinders is another project. Here the aim is to get cylinder manufacturers to agree on a common language for dimensional identification.

Allen Churchill of Automatic Switch reported that his valve ratings committee would prepare a brochure to provide data on rating and testing methods.

• **New officers**—Elected for the 1958-59 year were: president, J. A. Marsh who is vice president of Rivett Inc.; 1st v-p, L. L. Charlson who heads Char-Lynn Co.; 2nd v-p, Frank Flick, head of Flick-Reedy Corp.; treasurer, W. B. Kuhnke, who is vice president of Hanna Engineering Works. Newly elected directors are: R. W. Peterman, Galland-

Continued on page 28

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a good man to know when you buy hydraulic hose

FLEXON REUSABLE FITTINGS save time and money. All are equipped with Easy Grip Hex on stem for safe, speedy insertion into hose without the use of special mandrels.

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FLEXON ADAPTORS, UNIONS & CONNECTORS are available in a complete range of sizes and types for all services.

We're all looking for the best value, these days. But when it comes to hydraulic hose connections, a lot of factors have to be weighed to properly evaluate the overall value received. So let's take a look at these factors:

1. FIRST COST—mighty important, but it's rarely that you get a bargain on the basis of first cost alone.
2. LENGTH OF LIFE—when figured in conjunction with first cost you begin to get a better measure of actual cost.
3. EASE OF INSTALLATION—if you have difficulty assembling the hook-up for your requirements you can wipe out all the savings in Factors 1 and 2.
4. MANUFACTURER'S SERVICE — from the standpoint of prompt delivery and even more so from the standpoint of the technical aid, the service the manufacturer gives can provide the greatest value of all.

What does all this have to do with Mr. Flexon? He is the symbol of the Flexonics manufacturing and sales-service policies based on giving the buyer real hose value as outlined in the four points listed above. Talk to your local representative of Mr. Flexon, the next time you need hose. He's a good man to know, too.

Flexonics Corporation

HOSE DIVISION RH-15

Mr. Flexon identifies products of Flexonics Corporation that have served industry for over 56 years.

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In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Manufacturers of metal and rubber hose, expansion joints, metallic bellows and aircraft components.

BRIEFS

Henning Company; P. K. Rogers, Skinner Electric Valve Div.; V. J. Blasutta, Denison Engineering Div.; and H. S. Thompson, Commercial Shearing and Stamping Co.

Headquarters of the association are at 1618 Orrington, Evanston, Ill. Executive secretary is Barrett Rogers. ▼▼▼

Half Plane, Half Missile Uses Brazed Lines

A radically-designed rocket plane called the X-15 which will fly at speeds over 3600 mph, and have skin temperatures of 1000 deg F, is now being tested by North American Aviation, Inc., Los Angeles, Calif. All hydraulic tubing on the craft will be brazed to eliminate threaded fasteners

Brazed high pressure lines are pointed out by a North American Engineer on the mock-up of the X-15.

and reduce the chance of leaks. The brazing is done within the ship components during assembly. A metal sleeve is placed over the tube ends and a heating coil is wrapped on the sleeve. Heat melts a brazing alloy on the sleeve and tube ends to form a tight joint.

The entire plane's skin and wings are stainless steel. It is designed to carry man to outer space and back. The speed of the X-15 would permit it to fly from New York to Los Angeles and land 2-1/3 hours before it took off. ▼▼▼

Continued on page 30

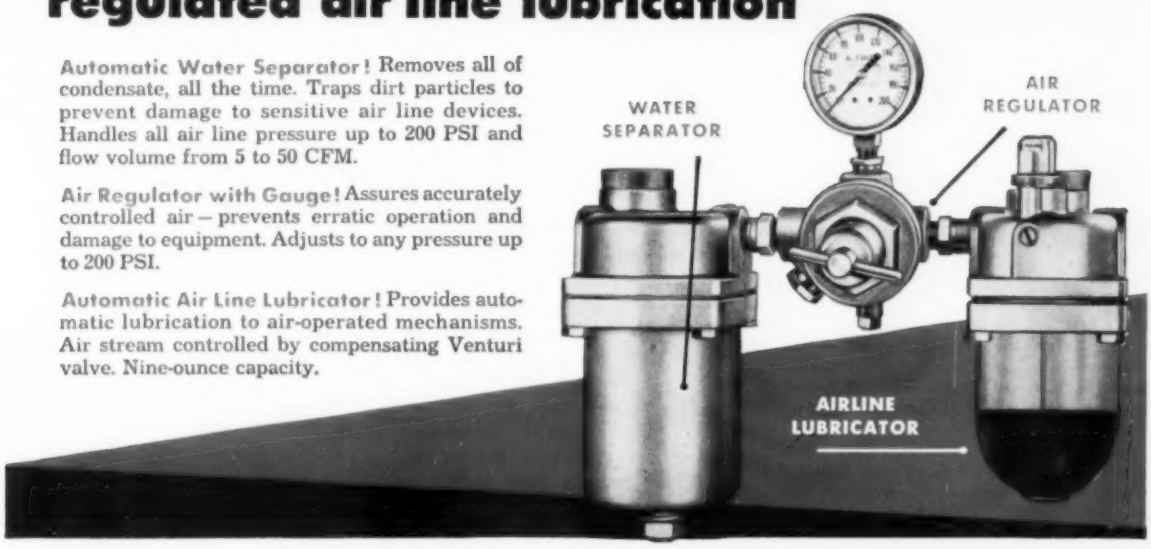
Alemite "Tri-Duty" air line controls!

All-New...for the cleanest, driest, best-regulated air line lubrication

Automatic Water Separator! Removes all of condensate, all the time. Traps dirt particles to prevent damage to sensitive air line devices. Handles all air line pressure up to 200 PSI and flow volume from 5 to 50 CFM.

Air Regulator with Gauge! Assures accurately controlled air – prevents erratic operation and damage to equipment. Adjusts to any pressure up to 200 PSI.

Automatic Air Line Lubricator! Provides automatic lubrication to air-operated mechanisms. Air stream controlled by compensating Venturi valve. Nine-ounce capacity.



All-New features offer outstanding advantages:

1. Single Unit Control Lubricator. Regulates the exact oil output required.

2. Visual Oil Counter. Oil sight dome in lubricator permits visual observation and count "per-drop" of lubrication.

3. Uniform Oil Mixture. Regardless of air pressure and volume!

4. Consistent Output. Oil and air mixture proportionately constant.

5. Easily Installed. Straight "inline" pipe connections . . . ½" p.t. inlet and outlet ports.

6. Wide Oil Range. Handles all viscosities of oil up to 500 SSU at 100° F.

7. Continuous Operation. Oil reservoir is refillable while unit is in operation.

8. Instant Oil Feed. For intermittent or continuous tool operation—no lag!

9. Filter Oil Tube. Removes all contamination from oil passing into air line.

10. Concentric Venturi Design. Assures constant, uniform mixture of air and oil.

11. Contamination-Free Air. Removable strainer in Air Regulator traps minute dirt particles.

12. Effective Control of Air Flow. Air Regulator eliminates excessive pressures and sudden surges.

13. 100% Condensate Removal. Water Separator removes and automatically dumps 100% of the condensate present in air lines.

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Please send me all the facts about Alemite's new "Tri-Duty" Air Line Controls.

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DESIGNED FOR HEAVY DUTY BUILT TO TAKE IT!

O-M Series TH
Hydraulic (oil) Cylinder
2000 psi operation
3000 psi Non-Shock
available in 1½ to 8" bores
Meets JIC Standards

Every engineering and construction detail of the improved O-M Tie-rod Hydraulic Cylinder adds to its overall operating efficiency under heavy work loads, assuring maximum smooth performance with minimum maintenance. It is ruggedly constructed of heavy walled, seamless steel tubing microhoned to minimize friction. The rolled steel heads are recessed to confine the tube, prevent breathing and to provide additional protection against leakage under the most severe conditions. Heads can be rotated independently at 90° intervals for convenient port location. The piston rod is of stress relieved, high tensile steel, hard chrome plated turned, ground and polished. The rod gland cartridge that is threaded for quick, easy removal, is accurately piloted in rod head to assure perfect alignment, also serves as pilot for cylinder mounted on rod end. Rod gland contains extra long bronze rod bearing for maximum support of piston rod.

Vee type, non adjustable, self compensating, rod gland packing provides multiple lip seal. Cartridge "O" ring, with leather back up furnishes a positive seal. Rod wiper or interchangeable metallic scraper prevent dirt from entering cylinder on "in" stroke. A complete selection of mounts is available.

These and many other features are described in detail in our latest catalog No. 105. Write for your copy TODAY or consult your local O-M representative.

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BRIEFS

FIRST EUROPEAN FLUID POWER CONFERENCE

John A. Lankester, APPLIED HYDRAULICS' European Editor, attended the First European Fluid Power Conference recently held in London, England. Over 200 users and manufacturers of hydraulic and pneumatic equipment attended the two-day sessions, organized by *Compressed Air and Hydraulics Magazine*. The first day covered pneumatics under the chairmanship of J. F. Holman, Holman Brothers Ltd. The second day was devoted to hydraulics, F. B. Levetus, Keelavite Rotary Pumps & Motors Ltd., chairman.

Here is a brief report on the ten papers presented:

• **Pneumatic Tools for Mass Production**—B. E. Wheadon outlined the development of power hand tools from the heavy machines in the 1920 to the fast lightweight units used today, many of them special purpose multiple tools. The paper described a two-speed pneumatic motor giving a fast, low-torque speed for running down nuts, followed by a slow, high-torque finish to tighten the nut to a predetermined value. Comparisons between the cost of pneumatic and electrical power tools were made.

• **Pneumatics for Automation**—W. G. Bennett listed the basic requirements for successful automation by pneumatics and illustrated a series of applications. One of these utilized pneumatic equipment to insert bristles in toothbrushes, producing 1200 brushes per hour.

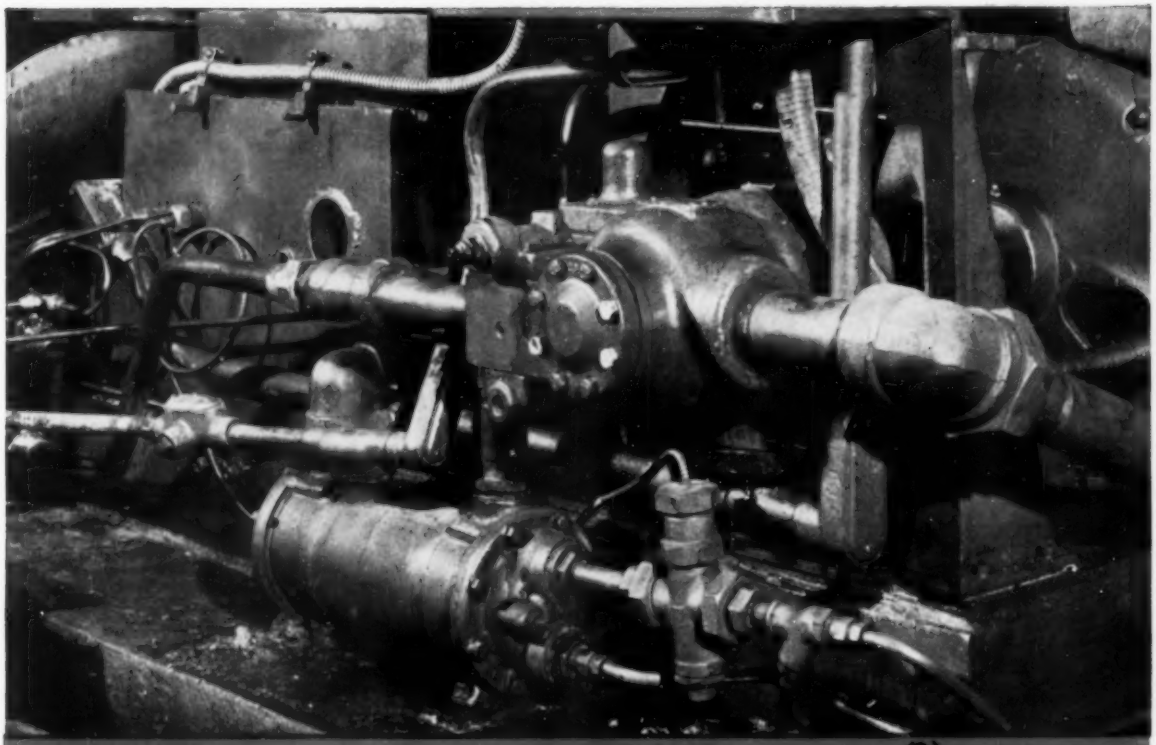
• **The Application of Electro-Pneumatics to Process Control**—R. E. Wilby surveyed some applications in such industries as tire manufacture, automatic mixing of constituents used in the production of rubber products, automatic canning retort control and high pressure hot water calendar safety circuits.

• **Soot Blowing by Compressed Air**—J. H. Camp reviewed the economics of the various methods of boiler cleaning systems.

• **Dry Air at High Pressure**—H. J. Podmore first discussed the damaging effects of moisture in pneumatic systems; also the means by which compressed air can be dehydrated, namely by condensation and adsorption, and the uses and combinations of these methods. He described several high pressure air applications and noted that in aircraft pneumatic systems the pressures have, in recent years, increased from 1,000 psi to over 3,000 psi and there are

Continued on page 32

E. H. Bowers, Ian McNeil and F. B. Levetus are listening to H. J. Podmore during the first European Fluid Power Conference.



Die caster takes Houghto-Safe out—TO SAVE (?) MONEY
...then brings Houghto-Safe back—TO SAVE PUMPS

In three years of continuous operation with Houghto-Safe 600 Series water-glycol fluid, the only downtime for this die casting machine was caused by a broken line. Houghto-Safe sprayed on molten metal. With oil-base fluid, it would have meant a serious fire. But production was resumed within a few hours, because Houghto-Safe didn't burn. Then came the decision to try a lower cost oil-water emulsion (Not Houghton's).

Savings appeared worthwhile when the oil-water fluid was installed. But in service, the fluid separated. Oil stayed at the top of hydraulic supply tanks. Water stayed at the bottom.

Result: fast and excessive pump wear. Within 6 months, downtime repairing pumps and waiting for pump parts became so great that the decision was made to replace the oil-water with a fluid with better lubricating power.

Houghto-Safe 600 Series fluids were again chosen, on the basis of their previous trouble-free performance and complete safety.

A costly test, but it shows why Houghton Engineers recommend Houghto-Safe 600 Series fluids for 85% of all applications. Houghto-Safe 1000 Series phosphate ester type fluids are recommended where temperature or design conditions do not permit the use of water-base fluids.

You can depend on Houghton hydraulic fluids for the best solution to hydraulic safety problems, for both best value and best service. Write today for Houghton's new hydraulic fluids bulletin. Get acquainted with the most complete line of fire-resistant and oil-base hydraulic fluids available from any single supplier today. Address: E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Pa.

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1 or 2 Cartridges

SERIES AX
3 to 18 Cartridges

SERIES QS
up to 198 Cartridges

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CUNO CARTRIDGES—

a wide range of sizes engineered for optimum efficiency. *Graded Density* wool and cellulose types and porous metal elements for maximum protection.

CUNO HOUSINGS—

a complete line of standard and special models designed to handle all Cuno Cartridges.

Cuno Filters are filtration engineered for a wide range of requirements from 5 to 75 microns.

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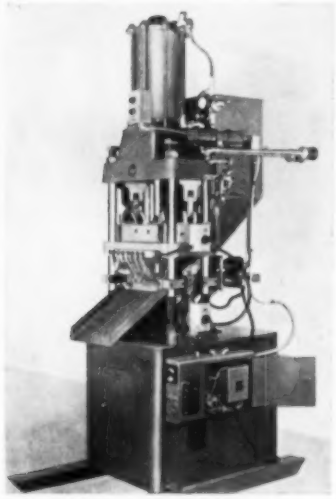
FILTRATION ENGINEERS IN PRINCIPAL CITIES

BRIEFS

indications that pressures as high as 6,250 psi are likely to become commonplace in the future.

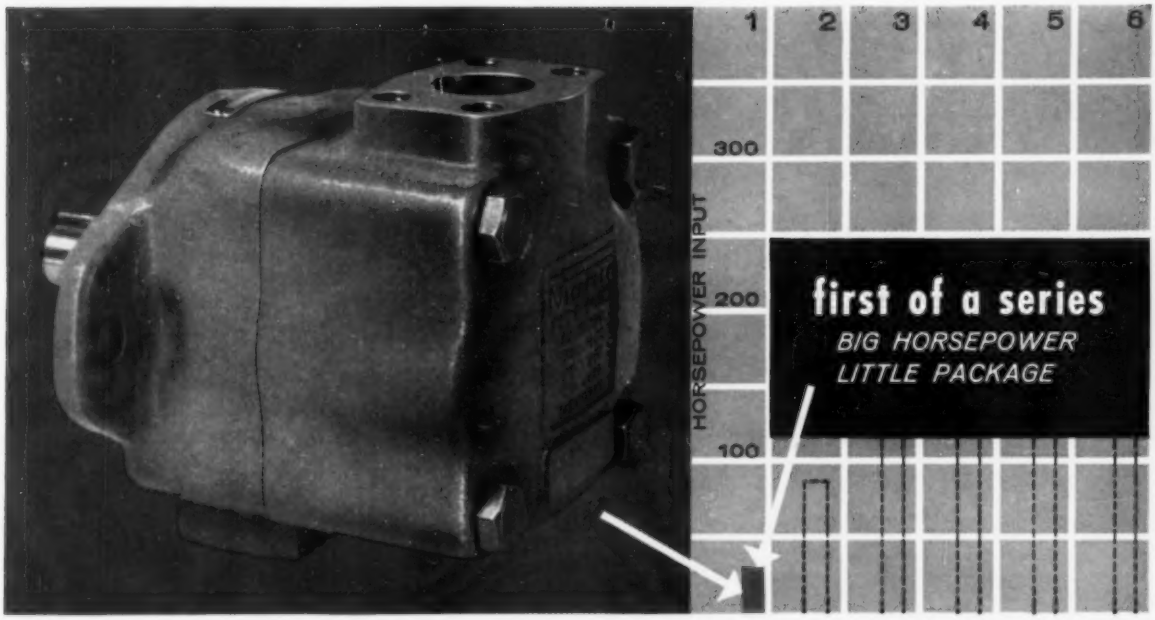
• **Modern Hydraulic Servo Techniques**—R. Hadekel after describing servo techniques in elementary systems, devoted his paper to the more "sophisticated" type of hydraulic force amplifiers in which fluid power systems responded to signals of electrical or electronic origin, such as used in aviation and computor controlled tools. Comments were made on characteristics of hydraulic servo valves, the effects of 'underlap' and 'overlap' and the linearity of these components. Performance problems of hydraulic servo mechanisms were also discussed.



HIGH SPEED, air-toggle, automatic plastic molding machine developed by Automatic Molding Machine Co., Los Angeles, Calif., operates on 100-psi shop air. Two models provide from 25 to 50 tons pressure. Electrical circuits are of simple design to keep maintenance at a minimum.

• **The Hydraulic Operation and Control of Machine Tools**—P. Wilson emphasized the versatility of hydraulic power and showed applications of hydraulic systems to a wide variety of machine tools.

Continued on page 34



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• high speed • high pressure • high efficiency • high service life

NEW COMPACT DESIGN . . . more than twice the horsepower of previous pumps in the same package size.

NEW VANE CONSTRUCTION . . . positive vane tracking at all speeds assures efficient operation at increased speeds and pressures.

NEW SIZES not previously available . . . answers mobile equipment designers' need for greater hydraulic horsepower in limited space.

NEW PARTS INTERCHANGEABILITY . . . many common parts for single and double pumps (two pumps on the same shaft in one envelope). Lessens inventory requirements.

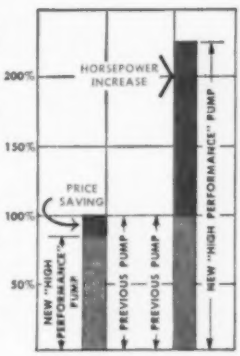
NEW 4-BOLT SAE FLANGE CONNECTIONS . . . will also accommodate user's 2-bolt flanges of the proper design.

NEW 2-BOLT MOUNTING (SAE 1959 STD.).

NEW REPLACEABLE PUMPING CARTRIDGE . . . all wearing parts of pump are incorporated in one replaceable cartridge. Easy field replacement without removing pump from its mount. Cartridges available in kit form.

MORE HORSEPOWER PER DOLLAR. The graph at the right makes a revealing comparison between this new pump and a previous pump of the same rated delivery. The new Vickers "High Performance" pump provides more than *twice the horsepower* at *less cost* while shrinking package size from 200 to 112 cubic inches.

The complete line of "High Performance" pumps (both single and double) is being readied for release. Size range will accommodate your largest requirements. This first model of the series is available in three ring capacities; 12 gpm, 14 gpm, and 17 gpm as shown in table below.



Model Number	Delivery-GPM 1200 RPM 100 PSI	Delivery-GPM 2000 RPM 2000 PSI	Input Horsepower @ 2000 RPM 2000 PSI	Package Size†	Weight
2V12A-**10	11.8	17.8	25.5	L. 5⅛" W. 4⅝" H. 5¾"	26 Lb.
2V14A-**10	13.6	20.4	29.0		
2V17A-**10	16.6	25.2	36.0		

†Exclusive of Shaft Extension and Mounting Lobes

8050

Write for new illustrated Bulletin No. M5108 for further details and performance characteristics.

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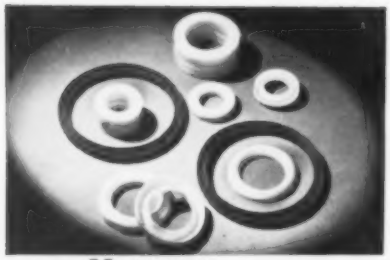
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

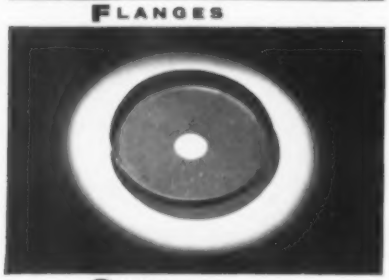


V-RINGS

PISTON RINGS

U-RINGS

FLANGES



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MADE OF
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TEFLON

Chemiseal hydraulic packings are made for every type of static and dynamic seal. They are available in pure TEFLON or in Filled TEFLON (glass, graphite, etc.) depending upon the application and service requirement.

Preferred by Leading Engineers

Because Chemiseal hydraulic seals provide the reliability of chemically impervious TEFLON, they are preferred by leading engineers for maximum security at vital points in aircraft and missile, automotive, marine, ordinance and industrial hydraulic systems.

Outstanding Advantages

Chemiseal hydraulic packings require no chemical inspection, have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents.

They offer unsurpassed antifriction properties, are tough, resilient, non-flammable, long wearing. They function equally well at any temperature from 100 degrees below zero to 500 degrees above.

Write for further information and samples for test.

United States Gasket Co.
Camden 1, N.J.

United States Gasket
Plastics Division of
GARLOCK

BRIEFS

• **Old and New Looks at Oil Hydraulics**—D. Firth, who is associated with the Fluid Mechanics Division of the Mechanical Engineering Research Laboratory, was able to draw from a wealth of scientific experiments conducted at this organization. He explained the effect of aeration of hydraulic fluids and the harmful results caused by poor design which allows air to become entrained in the hydraulic pressure medium. He discussed reservoir design and the design of pump suction pipes and also the effects of cavitation resulting from poor design of these. The paper also dealt with performance evaluation and pointed at some of the inaccuracies which can occur in flow, speed, pressure and torque measurements. Relief and check valves were also discussed.

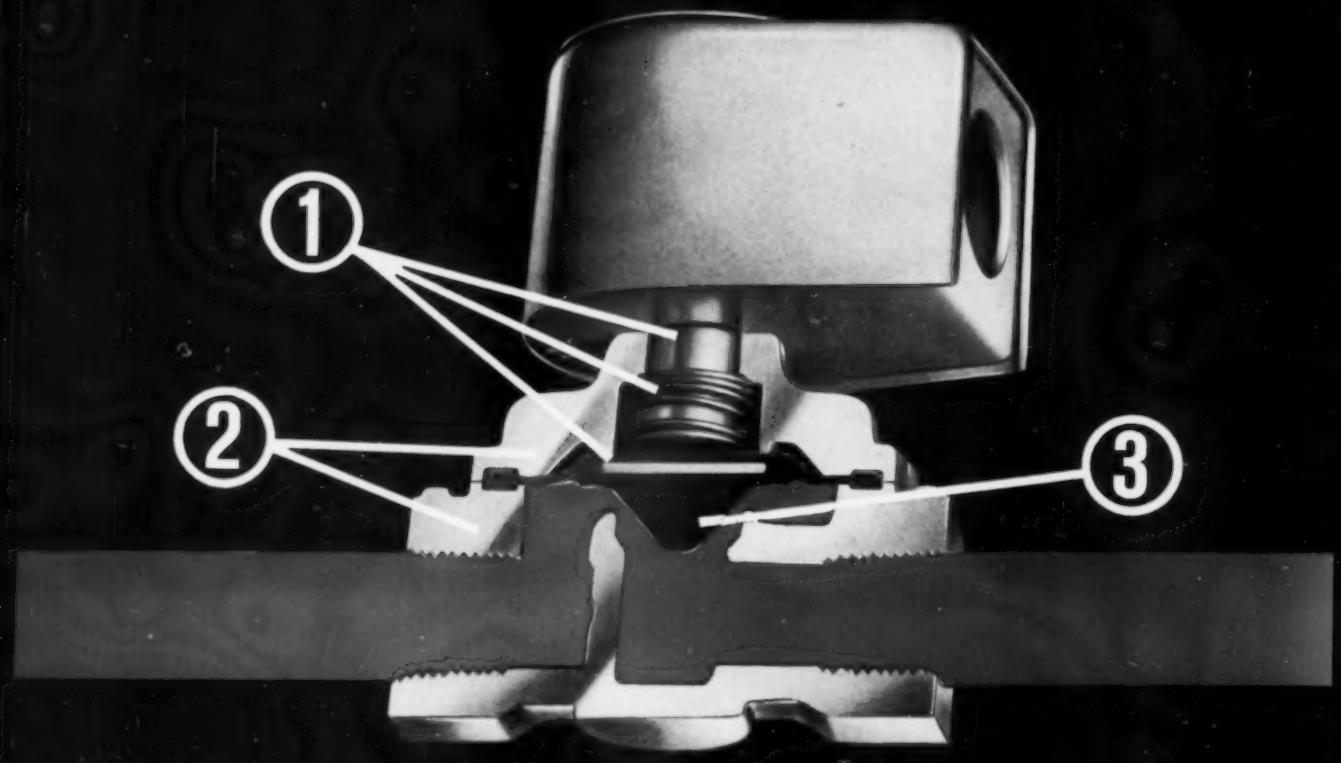
• **Hydraulics for Mobile Machinery**—E. H. Bowers outlined the general application of hydraulic power to mobile machinery and reviewed hydrostatic transmissions which he said promised important advances during the next few years.

• **Modern Trends in Heavy Hydraulic Machinery**—Ian McNeil explained that the demand for faster production speed and increased capacity was the reason for modernizing old, heavy machinery by the replacement of power sources with up-to-date equipment. He drew comparisons between a large American 4,500 hp pump giving 2,300 gpm at 3,000 psi and the much smaller British pumps giving some 50 gpm at 6,000 psi. Mr. McNeil advanced the opinion that for large press modernization it was preferable to install a battery of small pumps rather than one very large, expensive one. The comparison was also drawn between the large central hydraulic power system serving a number of presses and the self-contained direct pumping installation serving its own press. ▼▼▼

Continued on page 36

CIRCLE 103 ON TIME-SAVER CARD

SIMPLICITY, RUGGEDNESS, TIGHT SEATING,



WITH ASCO'S COMPLETE LINE OF 2-WAY SOLENOID VALVES

ASCO general purpose packless valves are now provided in a full ⅜" to 3" range . . . handle pressures up to 350 p.s.i. . . . ½" and ¾" sizes available to 1500 p.s.i. . . . provide dependable flow control for air, gas, water, light oil and other non-corrosive fluids.

Check these features of the Bulletin 8210A:

1. **Simplicity** in construction: Only three operational parts: all stainless steel core, stainless steel spring. Hycar diaphragm, ⅜"-¾" sizes . . . bronze piston ¾"-3" sizes.
2. **Ruggedness:** Forged brass bonnet and body insure freedom from porosity.
3. **Tight shut-off:** Assured by resilient disc construction.

Compactness: 2¾" face to face; 3¼" pipe center line to top of solenoid; 3-13/16" overall height. (Normally closed, ⅜" x ½" sizes.)

Mountable in any position: Normally open or normally closed.

Fast action: Rapid filling-venting operation permits cycling rate to 400 per minute.

All sizes have full area ports, continuous duty coils designed for low temperature rise and long life, and are available normally open or normally closed with standard, water tight or explosion proof solenoid.

Whatever the crucial factor in your flow-control application – reliability, compactness, high cycling rate – there is an ASCO valve that meets your need.

For Immediate Delivery . . .

World's largest stock of Solenoid Valves. A complete Solenoid Valve Stock List will be sent to you with your copy of Catalog No. 202.

New! Catalog No. 202 covers the ASCO line of Solenoid Valves. Write for your copy today.

SEE US AT THE
ISA SHOW BOOTH 1247
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Automatic Switch Co.

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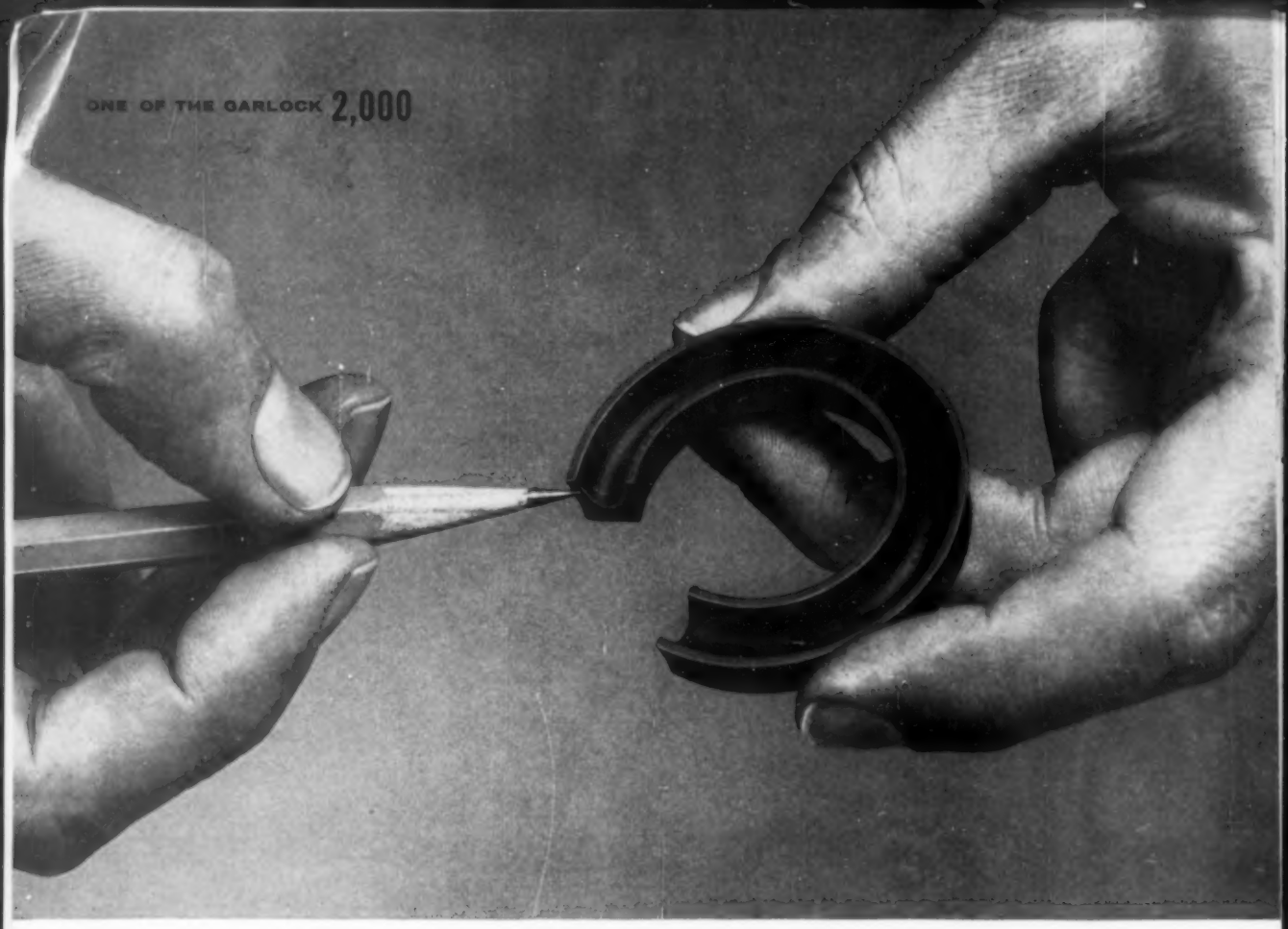
AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

ASCO®

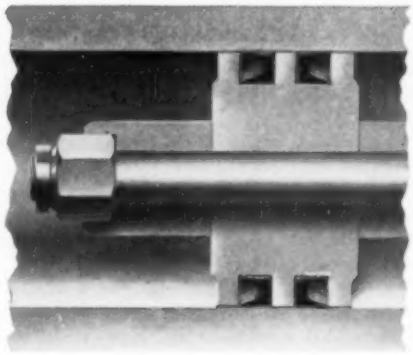
CIRCLE 11 ON TIME-SAVER CARD



NEW FLARED-LIP U-CUP PACKING REDUCES FRICTION

Garlock's new homogeneous U-cups are designed for minimum frictional resistance in low pressure air or hydraulic cylinder applications. They are molded of synthetic rubber with flared sidewalls which also facilitate assembly, especially when cylinder bores vary slightly in size. Instantaneous sealing after sudden pressure changes is another advantage of the flared-lip design. Sizes ½" O.D. to 3¾" O.D. are available from stock. Sizes to meet all AN6226 and JIC dimensional specifications.

Homogeneous U-cups are another part of the famous "Garlock 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet all your needs. It's the only complete line . . . it's another reason you get unbiased recommendations from your Garlock representative. Call him or write for AD163.



The new Garlock 9511 U-cup Packing is recommended for pressures to 2000 psi. The flared-lip design creates an interference fit especially adaptable to applications involving sudden pressure changes. Clearance at the heel reduces friction, makes assembly easier.

THE GARLOCK PACKING COMPANY, Palmyra, N.Y.

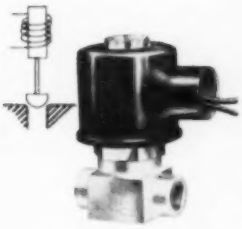
For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.

GARLOCK

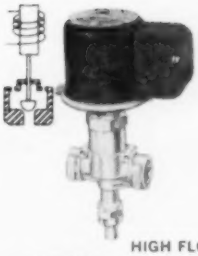
Packings, Gaskets, Oil Seals, Mechanical Seals, Plastic Products, Molded and Extruded Rubber

CIRCLE 44 ON READER SERVICE CARD

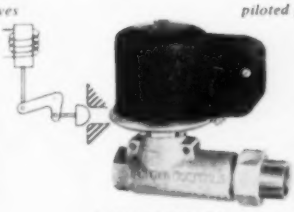
these six basic valves will meet any electric valve requirement you have



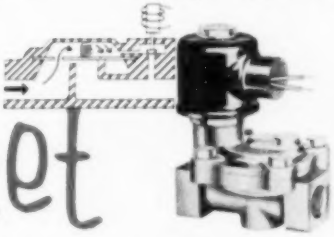
GENERAL PURPOSE
direct acting solenoid valves



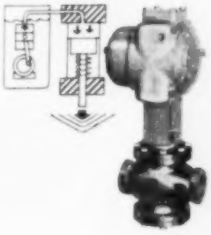
HIGH FLOW
piloted piston solenoid valves



HIGH PRESSURE
lever action solenoid valves



HIGH FLOW
magnetic diaphragm valves



HIGH VOLUME
HIGH PRESSURE
Hydramotor valves

HIGH POWER
Tork-Master valve operators

FROM 1/8" TO 60" PIPE SIZE

- normally open
- normally closed
- three-way
- four-way
- two-wire or three-wire control
- explosion-proof and weatherproof
- special body and seat materials
- odd voltages AC and DC
- UL, FM and AGA approvals

And with these GENERAL CONTROLS valves you get not only a complete range of sizes . . . but the right combination of operator *and* valve to do the job right . . . in terms of operating power, speed, capacity, flow characteristics and safety. You'll find the answer to your every electric valve problem in these GENERAL CONTROLS valves. Send for basic electric valve catalogs today.

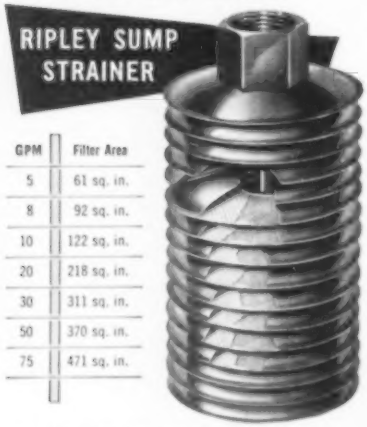
GENERAL CONTROLS

Manufacturers of America's Finest Automatic Controls for Home, Industry and the Military
Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada
Six Plants—42 factory branch offices serving the United States and Canada

CIRCLE 46 ON TIME-SAVER CARD

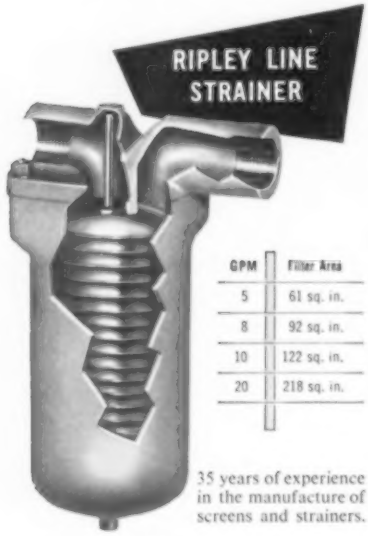
New Disc Design

GIVES YOU GREATER FILTERING AREA!



GPM	Filter Area
5	61 sq. in.
8	92 sq. in.
10	122 sq. in.
20	218 sq. in.
30	311 sq. in.
50	370 sq. in.
75	471 sq. in.

You'll find Ripley Strainers provide long, low-cost, trouble-free protection for your hydraulic equipment. Their self-cleansing discs have no crevices to clog or reduce flow—are assembled in standard combinations to give you *maximum* filtering area in *any* rated size! Available in sump and line models to meet your exact requirements. Send for complete information today!



GPM	Filter Area
5	61 sq. in.
8	92 sq. in.
10	122 sq. in.
20	218 sq. in.

35 years of experience in the manufacture of screens and strainers.

Ripley MANUFACTURING CO.
Filter Division
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Filter Division
RIPLEY MANUFACTURING CO.
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Gentlemen: Please send me complete information on your new disc type Sump and Line Strainers.
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BRIEFS

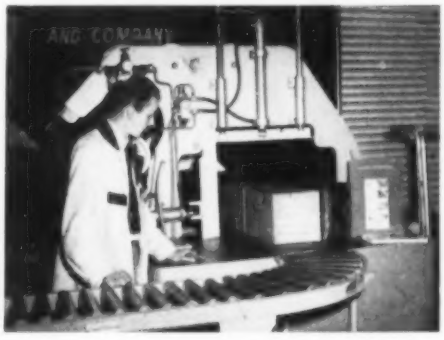
FLUID POWER AT THE MATERIAL HANDLING SHOW

An APPLIED HYDRAULICS Photo Report

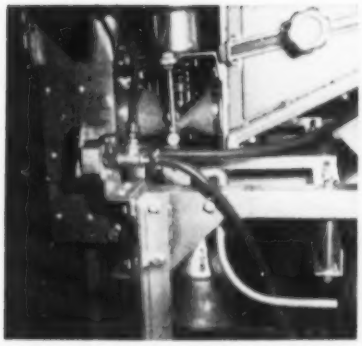
AH's intrepid editors stopped the advance of crane booms, got strappers to strap, hoppers to hop and levelers to level. All this with hydraulics or compressed air at the recent 1958 Materials Handling Exposition.

BIG 8-inch bore 16-inch stroke air cylinder raises and lowers this dock leveler. Operation is fully automatic, smooth and fast. T & S Equipment Co., Albion, Mich.

OIL POWERED screw conveyor converts any dump truck into an automated garbage loader. The screw is driven through a gear box by a gear type fluid motor which develops 6 hp. Motor speed of 1400 rpm is reduced to 35 rpm at the screw. A cross-bar linkage operating the 4-way valve, keeps the operator's arms at a safe distance from the screw. Stratton Engineering, Cleveland, O.

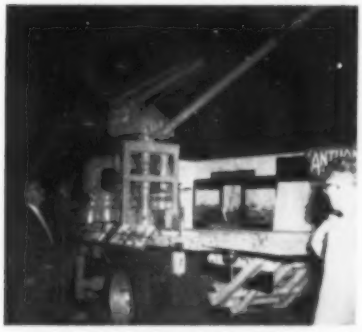


WIRE STRAPPING with air is fast. A tie is made on this machine in less than 2 seconds. Air at 80 psi powers cylinders which compress and hold the package as it's tied. A. J. Gerrard, Co. Melrose Park, Ill.



AIR cylinder shuts off material flow on this bag filling machine by pinching off a flexible tube. Automatic shut-off is controlled by bag weight. Used for packing granular and powdered material this machine includes several cylinders which actuate gating devices. Black Products Company, Chicago, Ill.

ALL-HYDRAULIC truck cranes are versatile and powerful and take up very little payload space. Two different hydraulic designs were displayed. On one, a rotary torque



actuator gives 280 degrees rotation. Only 18 inches of mounting space is required. A 24 gpm pump powers motions and handles a 5000 lb load. Truck-Crane, Streator, Ill.

On the second truck, rotary motion is developed by a vane type fluid motor which drives the boom through a gear reduction for a full 360 degrees. Boom extension,

elevation and rotation are controlled by three, 4-way valves. A remote control system can be attached to permit operator to follow the load and from a pushbutton panel in his hand control complete action. Daybrook Hydraulic Div., L. A. Young Spring & Wire Corp., Bowling Green, O.

One source for component parts really pays off... coordinated shipments, the same high quality standards, one responsibility are just a few of the many advantages. H-P-M is the source for a complete line of pumps, power units, valves, cylinders and system accessories. H-P-M's experience background in the design and building of hydraulic systems can be a real help when needed. Write today for a complete catalog. Ask for Bulletin 1101. Make H-P-M your standard for savings.

H826

HPM

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. COMPANY
A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

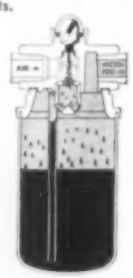
CIRCLE 58 ON TIME-SAVER CARD

AUTOMATIC LUBRICATION NEWS

How a Lubricating Fog for Bearings CUTS COSTS for Lubricant, Maintenance and Down-time

Better Lubrication

MICRO-FOG lubrication automatically coats all the bearings, gears, chains and other components of a machine with a continuous, protective film of clean oil. Just the right amount of oil is applied to provide the most efficient lubrication, reducing wear on machine components and cutting maintenance and replacement costs.



MICRO-FOG Principle

Oil Always Fresh, Always Clean

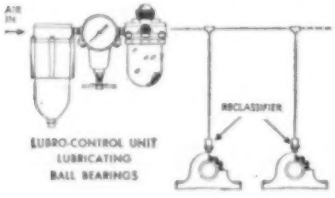
There is no recirculation of deteriorated or contaminated lubricant to cause wear or corrosion. Clean oil is applied continuously to all lubrication points in carefully metered amounts.

For Large and Small, Plain and Anti-Friction Bearings

MICRO-FOG Lubricating systems have found enthusiastic acceptance for use on all types of machinery. Actual applications range from dental drills with 3/32" bearings turning at 300,000 rpm to huge roll mill bearings on shafts as large as 34" in diameter, turning at 50 rpm.

Centralized, Automatic Lubrication

A single, MICRO-FOG Lubricator will automatically deliver enough airborne lubricant, proportionately distributed to completely lubricate a small or a large machine tool. Only one lubricator to maintain and refill.



Big Savings in Lubricant

Carefully metered quantities of oil are applied to each lubrication point. MICRO-FOG provides more thorough lubrication using only a few ounces of oil per day than other methods using several gallons of oil per day.

Bearings Run Cooler

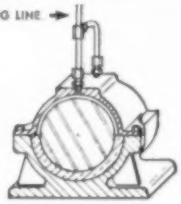
Air passing through the bearing carries away heat, and there is no pool of lubricant in the bearing to generate heat as a result of fluid friction. Lubrication is continuous—there are no periods of insufficient lubrication with metal wearing on metal.

Contaminants Excluded From Bearings

A slight positive pressure is maintained within the bearing housing, preventing the entrance of contaminants from the surrounding atmosphere.

Oil Filters, Sumps and Pumps Eliminated

There is no need to reclaim or recirculate because of the small quantity of lubricant used in MICRO-FOG Lubrication Systems. Expensive high pressure piping is also eliminated. Fewer bearing seals are required.



How MICRO-FOG is applied to a bearing.

Automatic Alarm Controls

MICRO-FOG Lubricators are available with automatic control devices to actuate an alarm system or controls as a warning of conditions affecting proper lubrication.

Visible and Adjustable Oil Feed

The oil feed is readily visible and adjustable on all models of MICRO-FOG Lubricators, offering proof that the lubricator is operating.

A MICRO-FOG Lubricator For Every Size Machine

20 Models to choose from—ratings up to 1,000 bearing inches and oil reservoir capacities up to 4½ gallons.

For all your air line filter, regulator and lubricator needs, call your nearby Norgren Representative, or WRITE FOR Descriptive Literature.

If it's Norgren... It's Dependable.

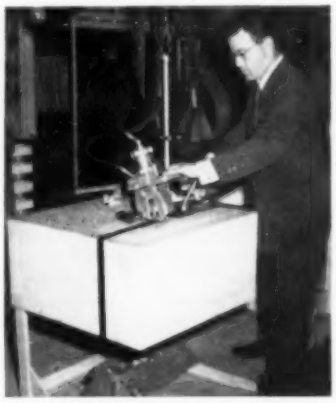
C. A. NORGREN CO.

3402 SO. ELATI ST. • ENGLEWOOD, COLO.

BRIEFS

INSIDE the truck body, the operator has complete control of body position. He can raise the entire truck body to any height up to 52 inches and lower it to ground level. Front and rear independent hydraulic cylinders allow the

truck body to be tilted in any direction so that the operator may utilize force of gravity while loading and unloading. An internal gear pump delivers 10 gpm at 1500 psi. Thompson Trailer Corp., Pikesville, Md.



4000 POUNDS of tension are applied by the hydraulically powered strapping unit. The power package housed in the cabinet includes a piston type pump. High pressure hose lines carry power to the tool. Complete control is at the tool which is easily maneuvered. Gerrard Steel Strapping Div., U. S. Steel Company, Chicago, Ill.

Hydraulic Cylinders Push Load

Designed for 4000-lb lift trucks, this pusher uses two short-stroke cylinders which push a face plate back and forth across the forks. Distance the face plate

Continued on page 42

CIRCLE 73 ON TIME-SAVER CARD

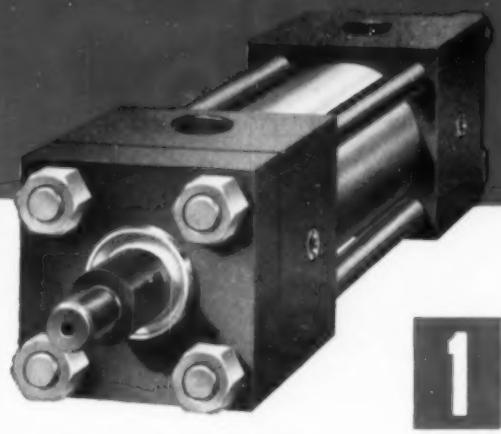
CIRCLE 70

SEAL FAILURE MEANS CYLINDER FAILURE

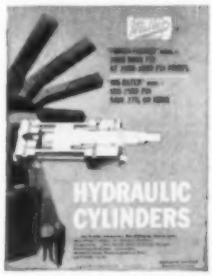
Petroleum base, fire-resistant and special hydraulic fluids cause distortion and rapid deterioration of the seals currently used in many hydraulic cylinders, resulting in costly repairs and cylinder failure. (Seals made of synthetic rubber are not compatible with even 50% of available commercial petroleum base fluids and the life of such seals is materially reduced at operating temperatures above 150° F.)

Specify Miller HYDRAULIC CYLINDERS

FOR UNLIMITED SEAL LIFE!



Request Bulletin JH-104N for complete data plus helpful charts on column strength, cylinder forces, factors of safety, acceleration, pipe pressure losses, etc.



1 ALL TEFLON* SEALED Against External Leakage

TEFLON is impervious to all known hydraulic fluids, including all fire-resistant and special types – and withstands temperatures from —100°F. to plus 450°F.

TEFLON SHEF SEAL AT TUBING ENDS

No blind assembly. Is

Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

TEFLON SEALS ON PISTON ROD AND BUSHING

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

TEFLON SEALS ON BALL CHECK AND ADJUSTING SCREW

Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

2 CASE-HARDENED CHROME PLATED PISTON RODS

Provide foolproof protection against seal failures resulting from rod damage. The Miller case-hardened rods (50-54 Rockwell C) give practically complete immunity to damage from hammer blows, wrench-dropping, mishandling, etc. The hard chrome plating over the case-hardened rods protects against scratch-damage and rust.

AVAILABLE IN TWO TOP QUALITY LINES

JOB-RATED
Model "J"

PRICE SAVINGS OF 27% OR MORE!

19 mounting styles, all strokes, cushioned and non-cushioned. Large selection for immediate shipment.

BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

POWER-PACKED
Model "H"

50% More Power Per Cylinder Dollar!

For

3,000-5,000 P.S.I.

1½" through 12" bores, 17 mounting styles, strokes up to 22 ft., cushioned and non-cushioned. Large selection for immediate delivery.

*DuPont trademark for its tetrafluoroethyline resin

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL

Teflon Pressure Energized

Hydraulic Cylinder Tubing End Seal
PAT. APPLIED FOR

OTHER MILLER QUALITY FEATURES

- Solid Steel Heads, Caps and Mountings.
- Precision-Honed Barrels.
- Rust-Resistant Coating on All Non-Wearing Surfaces.
- Space-Saving "Square" Design.

MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION

2008 N. Hawthorne Ave., Melrose Park, Illinois

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

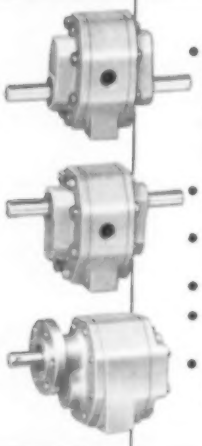
Precision-machined trouble-free hydraulic

PUMPS, MOTORS and VALVES

. . . by the World's Largest Builder of Hydraulic Jacks

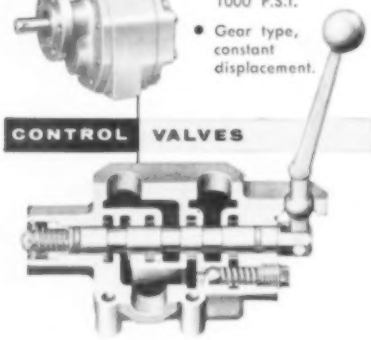
- Back of all Hein-Werner hydraulic controls are 30 years of engineering knowledge and precision craftsmanship.

PUMPS AND MOTORS



- Forced lubrication and internal bleeding for axial balance and to eliminate high pressures against oil seals.
- Rotate in either direction.
- Heavy-duty roller bearings.
- Small cube space.
- 8, 17, 25 GPM at 1000 P.S.I.
- Gear type, constant displacement.

CONTROL VALVES



- Large oil passages.
- Close grained, high tensile alloy body castings.
- 2 types of action.
- Spring centered, ball detent hold.
- Hardened ground spool.
- Precision honed valve body.
- Pressure relief valve
- Hardened seat insert for long life.

Hein-Werner Corporation, Waukesha, Wisconsin

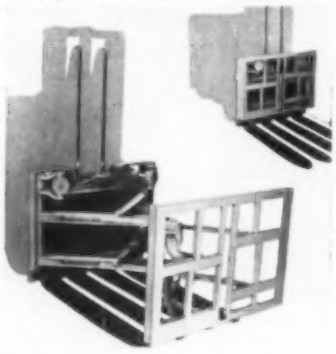
wide selection of models in stock . . . Hydraulic assemblies engineered to your specifications.

Manufactured by

HEIN-WERNER CORPORATION
WAUKESHA, WISCONSIN

BRIEFS

moves is amplified by a scissors type linkage. Alignment of the face plate is maintained by equal



flow of oil to each pusher cylinder. The cylinders are equipped with internal relief valves to relieve shock pressures. Made by Cascade Mfg. Co., Portland, Oregon. ▼▼▼

Air Suspension

A combination of hydraulic and pneumatic pressure is used to absorb shock in wheel suspension called "Hydair". The unit was designed by Le Tourneau-Westinghouse Co., Peoria, Ill., for heavy off-the-highway trucks where high pressure tires transmit considerable road shock.

The suspension consists of a cylinder secured to the truck frame with a moving piston secured to the wheel. A layer of oil for lubrication is held on top of the piston. The chamber above the piston, and the volume above the oil in the piston rod is filled with compressed nitrogen.

The area filled with oil below the piston is connected to the interior bore of the piston rod by a tube containing a control valve. Adjustment of the valve controls oil flow from under the piston to the interior of the piston rod,

Continued on page 44

BRIEF NOTES

NEW SEAL MATERIAL . . . Du Pont has a new fluorocarbon elastomer, Viton. Will perform at 400 deg. F and up. Can be processed on conventional rubber equipment. It's expensive, raw polymer is $15 a pound.

HIGH-PRESSURE . . . steel shut-off needle valves for 5,000 psi—in ¼ to ¾ in. sizes—will be introduced soon by Imperial Brass Co. The valves will use Hyseal tubing connections.

HALF A CENTURY OF SERVICE TO INDUSTRY . . . is the theme of U.S. Electrical Motors' Inc., observance of their 50th Anniversary. Founded in 1908 small store-front plant in Los Angeles, the company now operates six major plants and facilities located coast-to-coast and offices in all principal cities to service its far-flung sales and distribution organization.

HYDRECO DIVISION . . . is the new name for the New York Air Brake Company's Manufacturing division in Kalamazoo, Mich. Change was made to more closely associate the division name with the trade name "Hydreco".

THE HOUGHTON LINE . . . house publication of E. F. Houghton & Co. recently celebrated its 50th Anniversary. For the past 21 years this house organ, with a circulation of nearly 200,000, has been edited by Major Aaron E. Carpenter, chairman of the board of directors.

BUSINESS BRIEFS

MERGER . . . Hein-Werner Corp., Waukesha, Wisconsin, purchased Tal Bending Equipment Co., Inc., Milwaukee. Inventory and operation of Tal Bending will be moved to the Hein-Werner plant in Waukesha.

COMMERCIAL FILTERS CORPORATION . . . has acquired the Industrial Filtration Company, makers of Delpark Filters. Delpark will operate as a part of Indiana Commercial Filters Corp., with headquarters in Lebanon, Ind.

5 reasons why...

REPUBLIC ELECTRUNITE HYDRAULIC LINE TUBING

offers you more...at no extra cost–

1 QUALITY IS BUILT-IN

Republic ELECTRUNITE® Hydraulic Line Tubing is produced from highest quality flat-rolled open-hearth steel made in Republic's own mills to Republic's rigid specifications . . . assuring complete weld penetration and relative freedom from surface defects and seams, source of trouble in ordinary hydraulic line tubing.

2 QUALITY PROTECTED

Republic's exclusive ELECTRUNITE process, a continuous electric weld method that unites the wall under pressure without the addition of foreign or extra metal, is coupled with uniform heat treatment to assure uniform flaring characteristics. Complete recrystallization of the weld area is further assurance that the weld will react in an identical manner with the rest of the circumference of the ELECTRUNITE Tube.

3 EASY TO FABRICATE

ELECTRUNITE offers built-in dependability for easy fabricating because of its uniform heat treatment. Easy to bend—in any plane. Uniform bends, each length bends in the same manner as every other length. No dimensional evidence of the weld area can be found. No variation of the grain structure around the circumference of the tube is visible even under a microscope. Uniform wall thickness means uniform bends every time.

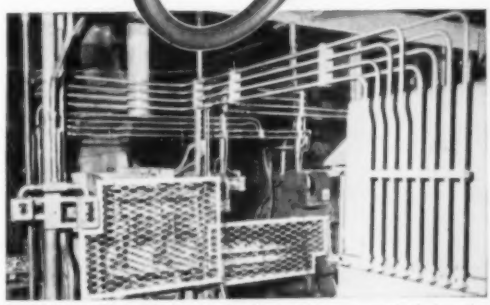
4 READILY ASSEMBLED

Close dimensional tolerances maintained in the drawing operation assures ease of assembly, reducing installation and maintenance costs. Exacting outside dimensional tolerances insures a tighter joint at the fitting, reducing the chance for leakage. The uniformity of ELECTRUNITE assures fast, economical assembly with either flare, non-flare or socket-brazed type of tube fittings.

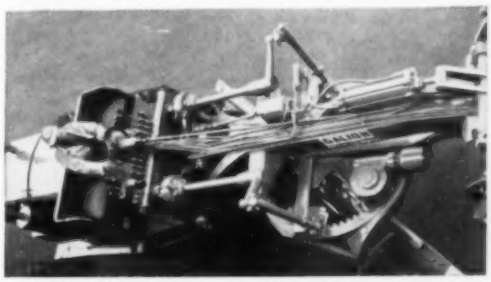
5 QUALITY TESTED AND PROVED

Every length of ELECTRUNITE is hydrostatically tested at a fibre stress of 20,000 lbs. psi., or an Actual Pressure of 5,000 lbs. psi., whichever is less, or FARROWTESTED® (Republic's exclusive non-destructive electrical test) to MIL-T-17188 or A-214. Written evidence that Republic ELECTRUNITE Hydraulic Line Tubing meets all the requirements of Specification HL-1 or any applicable customer's specification will be furnished when required.

For additional information, call your Republic ELECTRUNITE Distributor, or write direct.



Republic ELECTRUNITE Hydraulic Line Tubing supplied by the equipment manufacturer is used in the automation operations at the Dearborn Engine Plant of the Ford Motor Plant, River Rouge, Michigan.



Upwards of 100 feet of ELECTRUNITE Hydraulic Line Tubing is used in each of the Galion Road Graders to activate every mechanism with the exception of the brakes, with pressure surging up to 1500 psi.

REPUBLIC STEEL
STEEL AND TUBES DIVISION

REPUBLIC STEEL

Cleveland 8, Ohio

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-6025
211 EAST 131st STREET • CLEVELAND 8, OHIO

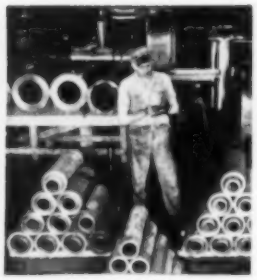
Please send additional Republic ELECTRUNITE Hydraulic Line Tubing information.

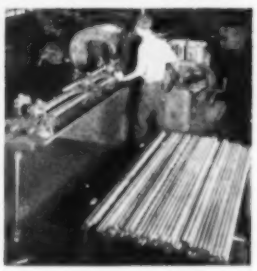
Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____





You machine better and faster with

SHENANGO CAST BAR STOCK

Because Shenango tubular stock is *centrifugally* cast, impurities and pockets are *forced* out of the metal in the molten stage. Moreover the grain is finer, pressure-dense and more uniform. This results in smoother machining, better control, and less waste of time and metal.

Made of high-strength Meehanite metal or long-lasting bronze, Shenango tubular stock comes in a *complete* range of I.D. and O.D. sizes. Its lengths go up to 20 feet, depending on diameter, which keeps cut-off waste to a minimum.

While the demand for Shenango bar stock is largely tubular . . . solid round, square, hexagonal, rectangular and other special shapes are readily available.

It will pay you to specify Shenango bar stock for longer wear, greater strength, fewer rejects . . . and lower over-all cost. For full information, write to: *The Centrifugally Cast Products Division* of The Shenango Furnace Company, Dover, Ohio.

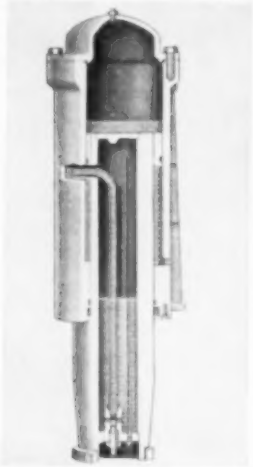
SHENANGO CENTRIFUGAL CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE® METAL • ALLOY IRONS

BRIEFS

varying the amount of shock absorption.

When the piston reaches ½ inch from the lower cylinder



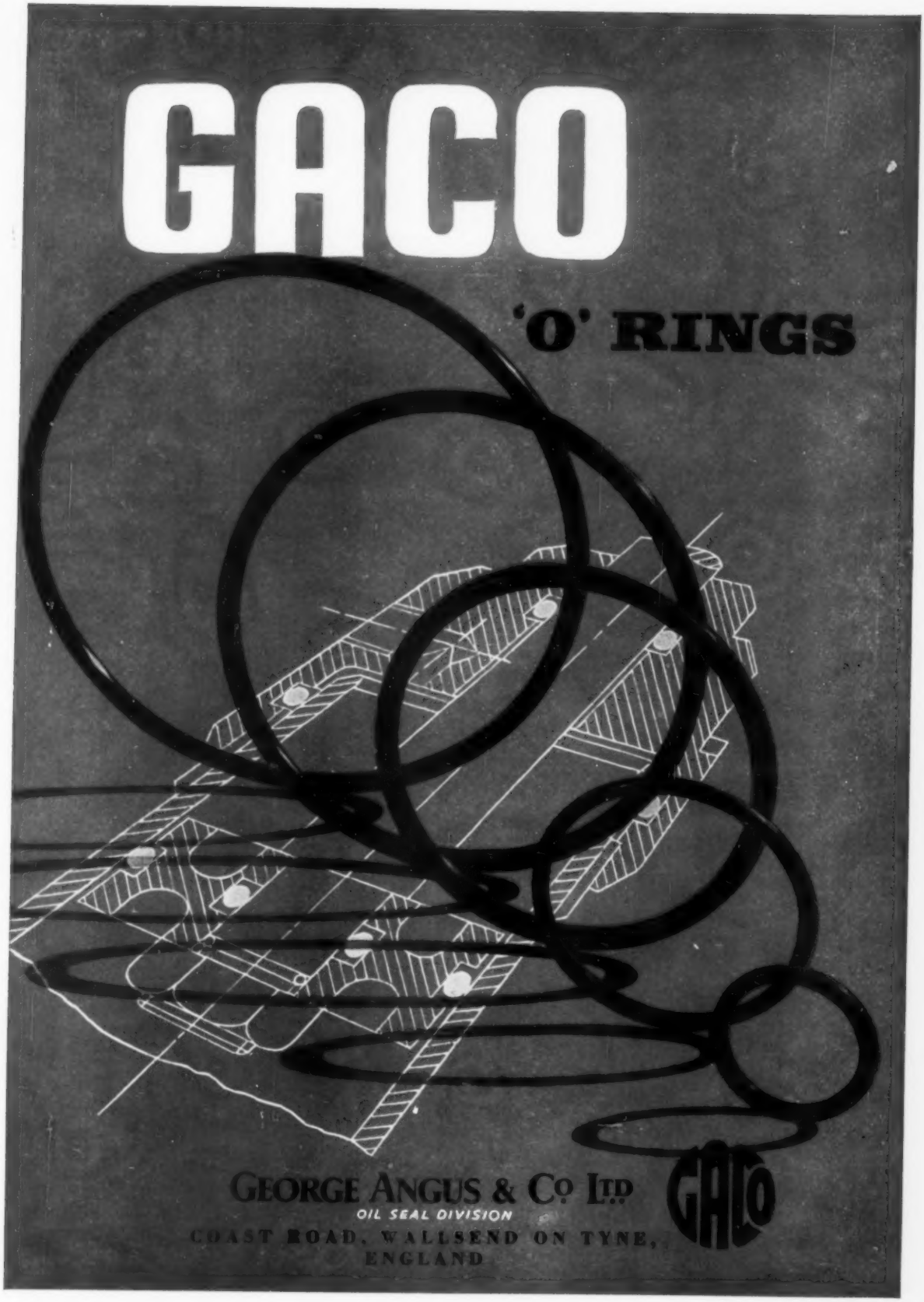
body, pressure in the cylinder rod chamber lifts the wheel off the ground, preventing the piston from striking bottom. ▼▼▼

High Temperature Testing

A new high temperature laboratory for testing of hydraulic control equipment has been completed by Hydraulic Research and Manufacturing Co., Burbank, Calif. Designed to provide a continuous 10 gpm flow through the

use of special re-circulation heat exchangers the facility will provide fluid temperatures up to 700 deg. F at pressures of 4000 psi or less, and ambient temperatures up to 100 deg. F.

One of the few such complete laboratories in the U.S., the facility permits continuous testing of hydraulic control equipment at elevated temperatures. It is available for outside contracting. ▼▼▼



CIRCLE 9 ON TIME-SAVER CARD

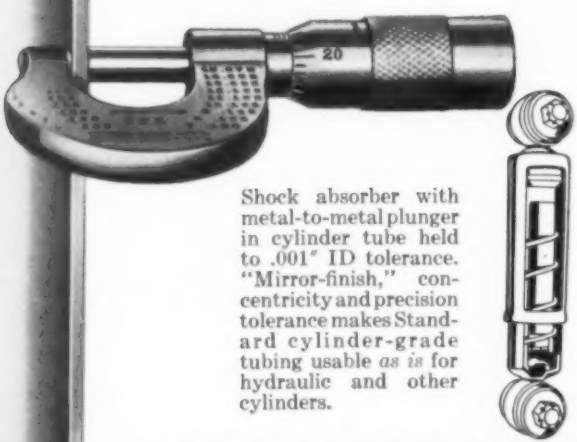
CYLINDER TUBING . . .

"mirror-finished" by Standard

Standard "mirror-finished" cylinder tubing is full-finished to use without further sizing or finishing for such applications as *automobile shock absorbers, power steering* and *hydraulic pumps.* When it comes to punishment, it can really take it. Every inch of this rugged tubing measures up to exacting specifications in cylinder finish . . . in ID tolerances as close as .001″ . . . in extreme uniformity of wall thickness and concentricity . . . in internal pressure resistance, *tested to shocks up to 9000 p.s.i.* Cylinder sizes to 3½″ OD x .187″ wall. For full information on Standard's complete range of products, plant facilities and engineering assistance send for *free* folder below.

- Welded Stainless Tubing and Pipe.
- Welded Carbon Steel mechanical.
- Boiler and Heat Exchanger.
- Exclusive rigidized pattern.
- Special Shapes.

Free 8-page folder on all Standard products. Write to address below.



Shock absorber with metal-to-metal plunger in cylinder tube held to .001″ ID tolerance. "Mirror-finish," concentricity and precision tolerance makes Standard cylinder-grade tubing usable *as is* for hydraulic and other cylinders.

STANDARD

THE STANDARD TUBE COMPANY and MICHIGAN STEEL TUBE PRODUCTS DIVISION

24400 Plymouth Rd. • Detroit 39, Mich.

Welded stainless tubing and pipe • Welded carbon steel mechanical Boiler and Heat Exchanger • Exclusive rigidized patterns • Special Shapes • Steel Tubing—Sizes: ⅛″ OD to 6″ OD—.028 to .270 wall Stainless—Sizes: ¼″ OD to 4¾″ OD—.020 to .187 wall.

FUTURE EVENTS

September 15-19: Instrument Society of America, 13th annual instrument automation conference and exhibit, Convention Hall, Philadelphia, Pa.

September 22-24: Standards Engineers Society, 7th annual meeting. Benjamin Franklin Hotel, Philadelphia, Pa.

September 29-October 3: ASTE Semi-Annual Meeting and Western Tool Show. Shrine Exposition Hall, Los Angeles, Calif.

October 13-15: ASME-ASLE Lubrication Conference, Statler Hotel, Los Angeles, Calif. Papers will be presented on lubrication, wear, and high temperature. For further information contact R. B. Purdy, 150 East 42nd St., New York City.

October 14-16: Society of Industrial Packaging and Material Handling Engineers. National Exposition, The Coliseum, Chicago, Ill.

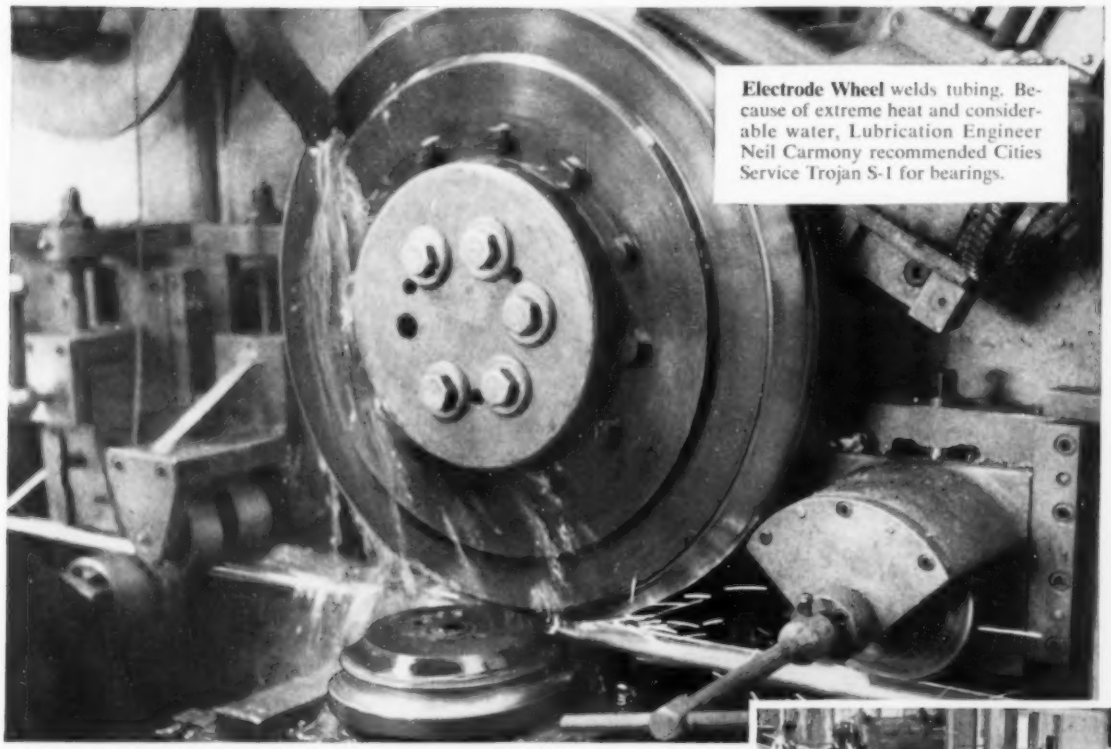
October 16-17: NCIH 14th Annual Meeting. Sherman Hotel, Chicago, Ill. For complete information write Raymond D. Meade, Conference Secretary, Illinois Institute of Technology, Chicago, Ill.

October 27-31: American Society for Metals, National Metal Exposition and Congress. Public Auditorium, Cleveland, Ohio.

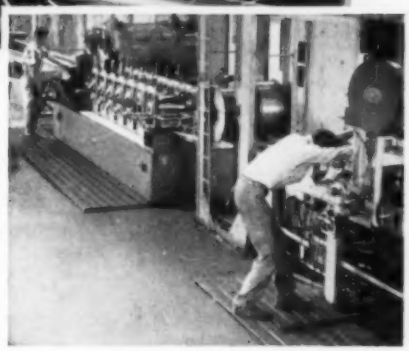
November 3-5: National Fluid Power Association fall meeting, Drake Hotel, Chicago, Ill. For information write Barret Rogers, Executive Secretary, 1618 Orrington, Evanston, Ill.

December 4-5: Industrial Engineering Conference, Illinois Institute of Technology, Chicago, Ill. ▼▼▼

New Tubing Mill Produces at Speed of 350 Feet Per Minute!



Electrode Wheel welds tubing. Because of extreme heat and considerable water, Lubrication Engineer Neil Carmony recommended Cities Service Trojan S-1 for bearings.



It's Cities Service for Hydraulic System and all lubrication

On January 1, 1957, P&H Tube Corporation put a new mill in production at Bossier City, Louisiana—the only one of its kind in the United States.

Equipped with special drives and worm gears, this unique mill actually produces at the rate of 350 feet per minute—twice the speed of conventional tubing mills!

With speeds like this, you might expect lubrication troubles . . . but P&H Tube Corporation has none. One big reason is the careful study of each machine made by Cities Service Lubrication Engineer Neil Carmony—and the lubrication recommendations he made.

In hydraulic units, for example, Carmony recommended Pacemaker 200-T Hydraulic Oil . . . for he knew its ability to withstand the severest operating temperatures and speeds. He knew that due to its exceptionally high viscosity index and superior compounding, Pacemaker 200-T would give maximum resistance to thinning, oxidation, rust and corrosion.

The wisdom of this decision, as well as the choice of other lubricants shown in the chart at right, was demonstrated recently when P&H Tube Corporation ran off 125,000 feet of tubing in an ordinary eight hour shift—with normal time-out for change-overs!

That's production with a capital P! And if you'd like to improve your production picture, a Cities Service Lubrication Engineer can help you, too. Call the nearest office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

What the Cities Service Lubrication Engineer Recommended

Hydraulic units	Pacemaker 200-T
Bearings	Trojan H-2 Grease
Drive units	Pacemaker Oils
Bearings by the mill's electrodes	Trojan S-1

CITIES SERVICE

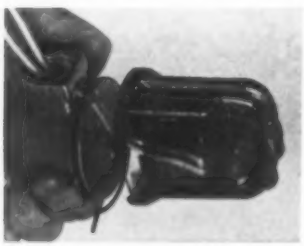
QUALITY PETROLEUM PRODUCTS

CIRCLE 22 ON TIME-SAVER CARD

NEW PRODUCTS

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

PILOT SOLENOID AIR VALVES . . . are fast acting



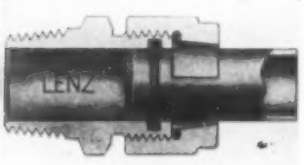
Features: Shock-resistant solenoid mounted in valve cover. Unit will not operate with cover off. Both cover and solenoid can be removed without tools. Each valve is factory tested at over 600 cpm. Continuous duty solenoid is cushioned with rubber inserts to absorb impact of plunger.

Specifications: Current requirements 0.8 amp in-rush and 0.125 amp holding at 115 v, 60 cycle. Working pressure 125 psi. Porting ¼-in. NPT.

Mechanical Air Controls
Detroit, Mich.

CIRCLE 300 ON TIME-SAVER CARD

TUBE AND PIPE FITTINGS . . . have O-ring seal



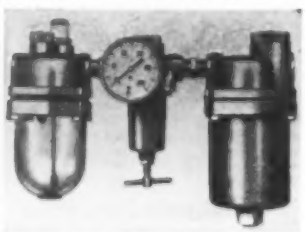
Features: At low pressures the resilience of the O-ring does the sealing. At high pressures distortion of the O-ring aids in sealing. Tubing need not be cut to exact length. A split, tapered sleeve holds the tubing in place when the clamping nut is tightened. Fittings are shock and vibration resistant.

Specifications: Made in all standard shapes from ⅛ to 2 inch, with cadmium plated or black phosphate finish. Can also be furnished in stainless steel.

Lenz Company
Dayton, Ohio

CIRCLE 301 ON TIME-SAVER CARD

AIR LINE CONTROLS . . . filter, lubricate, & regulate



Designation: Tri-Duty

Features: Unit has low pressure drop and will handle flows to 50 cfm. Lubricator has a self-compensating valve that varies the oil with changing air volumes. Oil is admitted to the center of the air venturi giving uniform particle size with little drop out. An oil sight dome gives visual observation of lubrication.

Filter uses a baffle-type water separator and a strainer for removing rust and scale. All three units have ½-in. NPT ports.

Alemite Division
Stewart-Warner Corp.
Chicago, Ill.

CIRCLE 302 ON TIME-SAVER CARD

HYDRAULIC POWER UNITS . . . are compact

Specifications: With standard pumps, motors, valves, and reservoirs, a self contained unit can be made for ½ to 4 gpm at 1800 rpm and 2000 psi. Higher flow at 3600 rpm. Pumps can be supplied with check valve, relief valve, and manual or solenoid valve. Electric motors ¼ to 2-hp ac, and 6, 12, and 24-v dc.

Applications: Dock leveling, tractors, snow plows, dump bodies, tail gate unloaders, and lift trucks.

John S. Barnes Corp.
Rockford, Ill.

CIRCLE 303 ON TIME-SAVER CARD

Continued on page 50

Photo courtesy of Pettibone Mulliken Corp., Chicago, Ill.

MARVEL Synclinal FILTERS

are Standard Equipment on

Pettibone "SPEED SWING" 180 Degree Swing Loaders

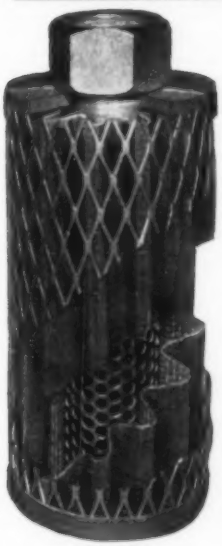
MR. A. T. LOGUS, Chief Engineer of Pettibone Mulliken Corp. expresses preference for Marvel Synclinal Filters as follows—

(A) *"The ratio of the total filtering net area to the net area of the inlet pipe is much higher than any other oil filter on the market.*

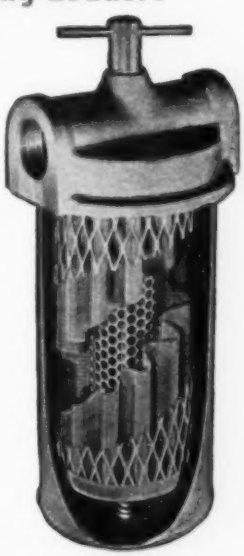
(B) *The direct result of the high area ratio is lower hydraulic pressure drop over prolonged operating periods.*

(C) *All materials used in manufacturing the Marvel Filters are impervious to corrosive action from the additives and other elements contained in oil.*

I might add that the price of these filters is lower than some makes of oil filters that are much less desirable on the basis of the above three points."



SUMP TYPE (Cutaway)



LINE TYPE (Cutaway)

OVER 800
Original Equipment Manufacturers

of stationary or mobile equipment utilizing hydraulic or other low pressure liquid circulating systems are installing Marvel Synclinal Filters as Standard Equipment.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

EASY TO CLEAN

Both sump and line types are easily disassembled, thoroughly cleaned and reassembled, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

IMMEDIATE DELIVERY

Catalogs contain dimensional charts and complete engineering data making it easy to order a filter for your specific requirements and get Immediate Delivery.

For further information, write, wire, phone or use coupon below

MEET J.I.C. STANDARDS

MARVEL ENGINEERING COMPANY
7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Filters, as indicated: (AH-8)

- ☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

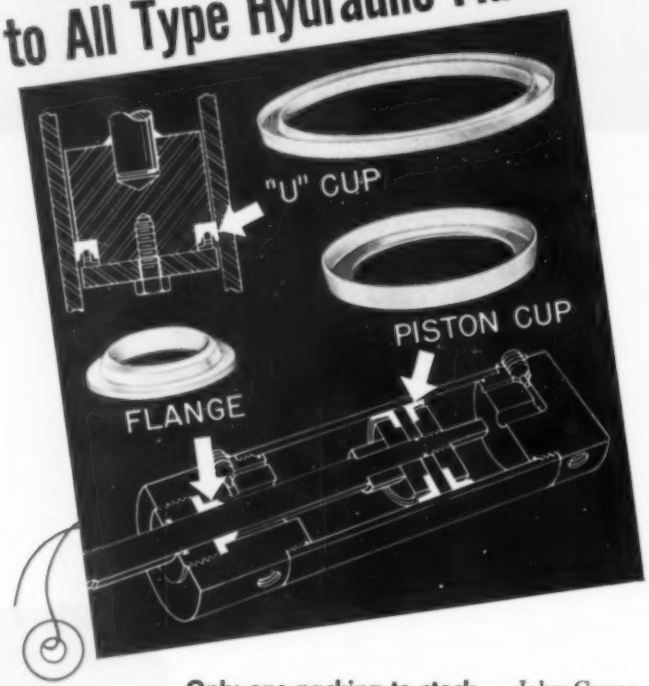
Name _____ Title _____

Company _____

Address _____

City _____ State _____

CHEMLON® ...the one Packing Solution to All Type Hydraulic Fluids

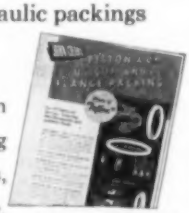


FOR ALL HYDRAULIC FLUIDS:
PHOSPHATE ESTERS
GLYCOLS
SILICONES
WATER EMULSIONS
PETROLEUM BASE
ALL OTHERS

Only one packing to stock . . . John Crane Chemlon Piston Cup, U-Cup and Flange Packings are the answer to handling *all* types of hydraulic fluids. Machined from chemically inert Teflon,* they give positive sealing and long-lasting performance not possible with leather, fabric-reinforced or similar packings.

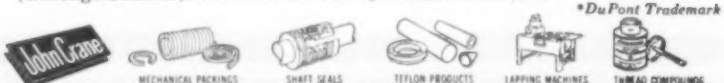
Heat will not cause these packings to shrink away from the cylinder walls or rod. They will not harden, shrink, swell or in any way disintegrate under higher temperatures often encountered in hydraulic service. Their exceptional thermal characteristics provide an operating range from −94°F. to +350°F.

Here . . . in a wide range of sizes or fabricated to your individual specifications . . . is a complete line of hydraulic packings to meet the need of any operating requirement.



Write to "John Crane" Send now for bulletin giving full technical and application data. Crane Packing Company, 6405 Oakton Street, Morton Grove, Illinois, (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

*DuPont Trademark



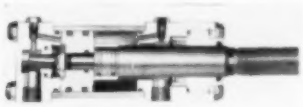
CRANE PACKING COMPANY

CIRCLE 27 ON TIME-SAVER CARD

NEW PRODUCTS

AIR AND OIL CYLINDERS . . . meet JIC standards

Features: Designed to meet the latest automotive standards for high-speed automatic production. Cylinders have tie-rod construction



and special composition V-type piston seals. Rod packing cartridge is easily removed for repacking.

Specifications: Meet all JIC standards and are made for 200-psi air pressure and 1000-psi hydraulic pressure.

Ortman-Miller Machine Co., Inc.
Hammond, Ind.

CIRCLE 304 ON TIME-SAVER CARD

MINIATURE SOLENOIDS . . . for multi-million cycles

Designation: Series 01 and 02

Features: Silicon steel field and plunger prevent residual magnetism and reduce eddy current and hysteresis losses. Heat treated beryllium copper plunger guides. Shading coils silver brazed into field assembly for quiet hold and

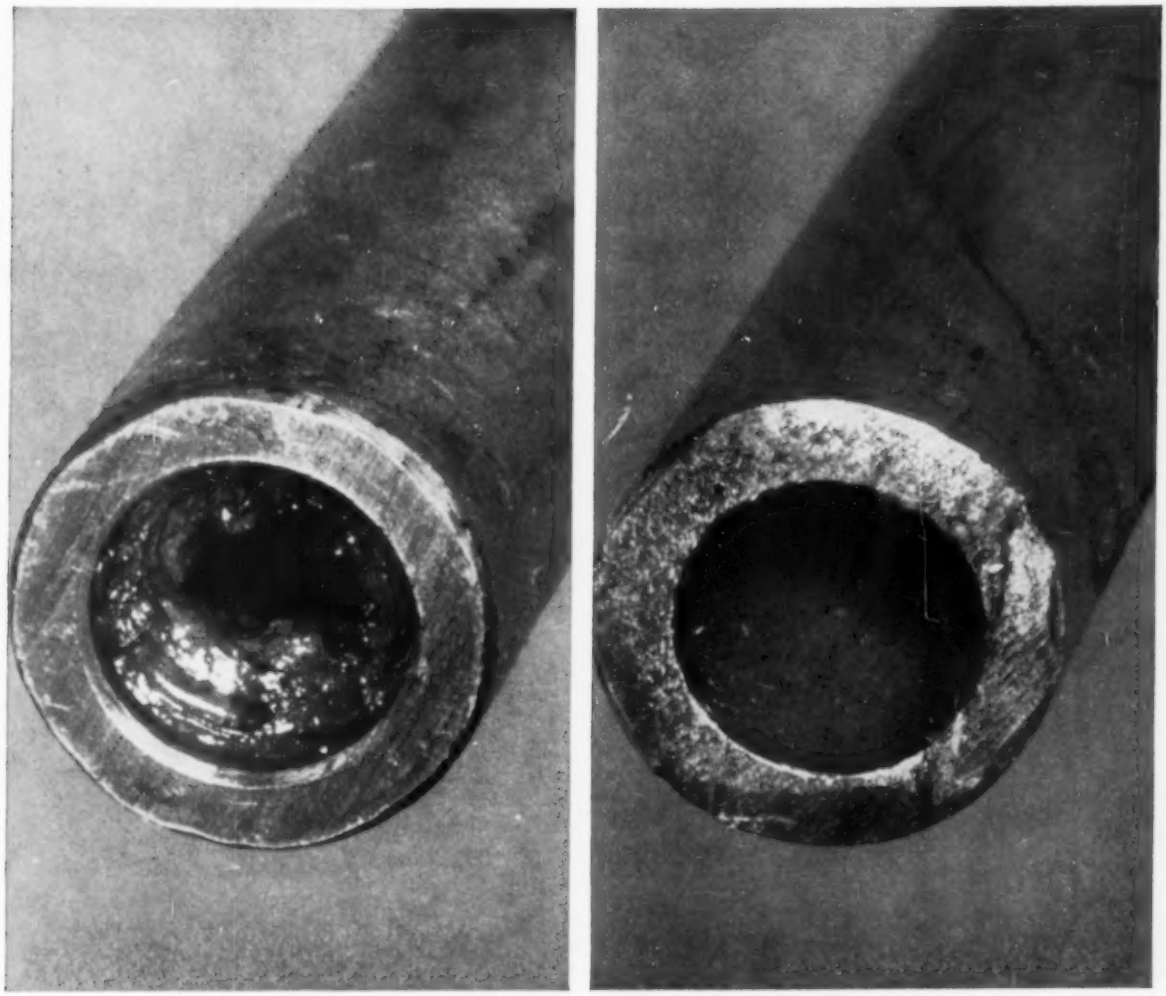
longer life. Coil can be replaced in 30 sec.

Specifications: The 01 series has 1¾ lb force at ½ in. stroke and holds at 4¾ lb. The 02 series has 2¾ lb force at ½ in stroke and holds at 5½ lb.

Detroit Coil Co.
Ferndale, Mich.

CIRCLE 305 ON TIME-SAVER CARD

For more NEW PRODUCT reviews turn to page 108



This sludge-clogged hydraulic line . . . looked like this, after cleaning with a Sunvis 700 oil.

With Sunvis 700 oils, you can clean hydraulic systems and keep them clean

Sludge, caused by high temperatures, and by water, dirt, cutting oils, paint, packing, and by many other contaminants, clogs lines and cuts efficiency.

Sunvis* 700 oils keep these contaminants in suspension, and carry them away to the filters, thereby keeping systems clean and preventing costly shutdowns. In fact, many seriously fouled systems can be cleaned and kept clean permanently by a switch to Sunvis 700 oil. A single charge of Sunvis 700 oil can keep even a continuously contaminated system running smoothly for months, often *years*.

Your Sun man knows Sunvis 700 oils inside out. He has facts, figures, and case histories that prove their quality... quality that means *money in your pocket*. Call him in soon. Or write to Dept. AH-8,

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

*TRADEMARK © 1958 SUN OIL COMPANY

In Canada: Sun Oil Company Limited, Toronto and Montreal

ACCO
Helicoid Gage
U.S.A.

NOTHING BUT THE BEST IN GAGES FOR WORKING PRESSURES FROM 30" VACUUM TO 10,000 p. s. i.

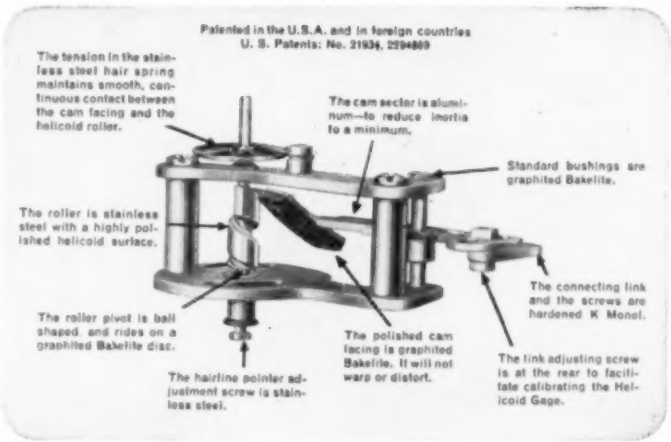
Shock-Proof Cam Actuation (no gears—no teeth) Makes Helicoid Gages Ideal for Hydraulic Services

Designed for pulsating and impact hydraulic service, the Helicoid movement releases at zero in the event of sudden pressure reduction. This eliminates shock on pointer and movement by reducing impact of pointer against pointer stop pin. This protects the gage mechanism where gages may be subject to occasional vacuum.

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or certain severe mechanical vibrations.

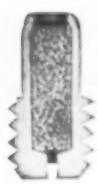
The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown at the right.

Rolling action of the cam facing against the roller surface . . . graphited Bakelite bushings, roller pivot base and cam facing . . . K Monel connecting links and screws . . . all such Helicoid features protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation through millions of cycles.


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21934, 2294869
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

HELICOID GAGE CARTRIDGE SNUBBER

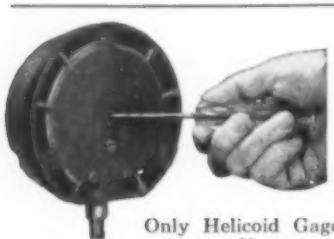
(Patent pending)



This is a simple, effective throttling device to reduce or eliminate pulsations of the gage pointer. There are no moving parts, no adjustments needed. Available in three types in powdered bronze or stainless steel for air, gas, water, steam, medium or heavy liquids.

Enlarged cutaway view

Threaded cartridge body for assembly in any Helicoid Gage tapped socket shank



EASIEST ADJUSTMENT AND CALIBRATION

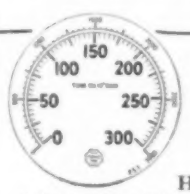
Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

TUBES BUILT FOR MILLIONS OF PRESSURE PULSATIONS

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials—alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak nor crack.



DOUBLE SCALE DIAL SHOWS TONS ON RAM AND PSI

Helicoid Gage dials are supplied in jet black with white figure markings or in dull white with black figure markings. They are constructed of laminated phenol with a transparent plastic surface and the longest possible scale length for more accurate readings. They are non-corroding, will not discolor nor fade and will not crack, chip nor peel.

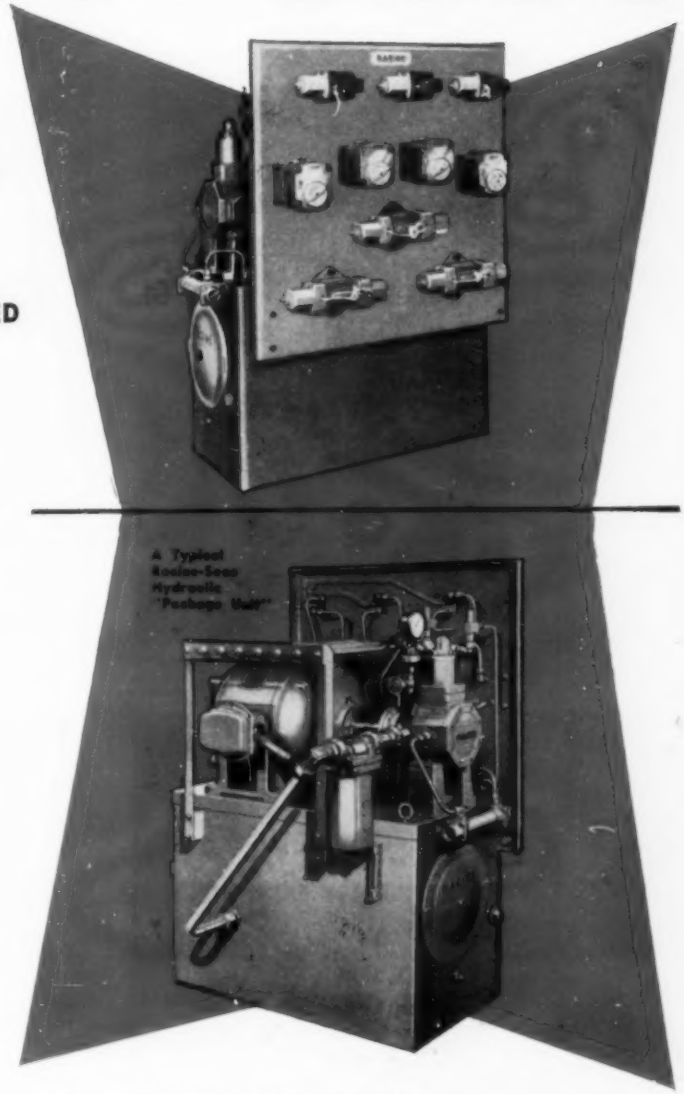
Helicoid Gage Division
AMERICAN CHAIN & CABLE

929-H Connecticut Avenue • Bridgeport 2, Connecticut

ACCO
A·C·C
TRADE MARK

Helicoid gives you all these features at prices that are competitive in the quality gage field

LET RACINE-SECO engineer your hydraulic needs



WHY RACINE-SECO FACTORY-ENGINEERED, FACTORY-ASSEMBLED "HYDRAULIC PACKAGE UNITS" ARE BETTER FOR YOU

1. These units are designed, engineered and built with Racine-Seco-made components to your specific machine operation needs.
2. Compact — requiring a minimum of floor space.
3. All components easily accessible for quick servicing.
4. Complete and ready for immediate hook-up to your service lines.
5. Control valves positioned on easily accessible, clearly designated control panel.
6. Field sales and service representatives in all principal cities.

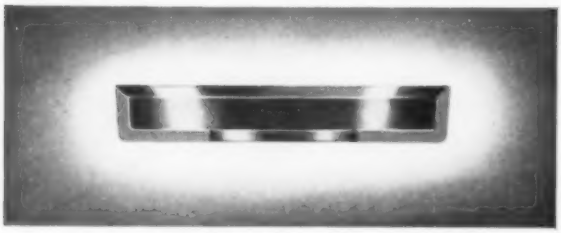
Investigate RACINE-SECO'S *free* engineering service. Let Racine Hydraulic specialists relieve your engineering load. Utilize this responsible single source of supply. Write us about your hydraulic projects. No obligations.

RACINE SECO

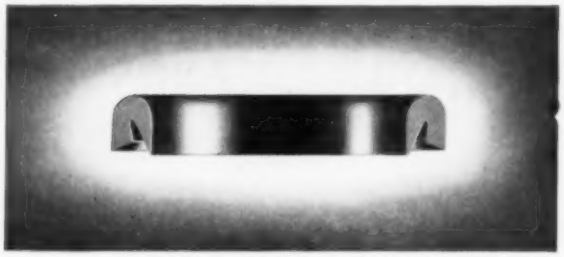
RACINE HYDRAULICS & MACHINERY, INC.
2074 Albert Street, RACINE, WISCONSIN

Simplify your sealing problems...

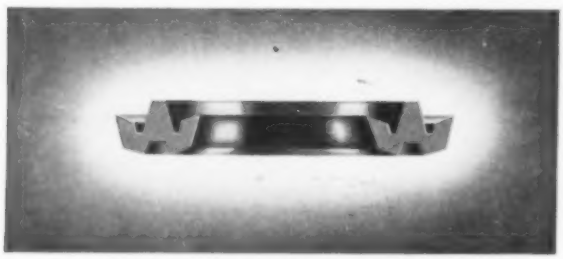
with Johns-Manville Precision moulded packing designs for pressure applications in hydraulic and pneumatic equipment



1. Type "A" Packing Cups for pistons
(the original "square heel" cup design)

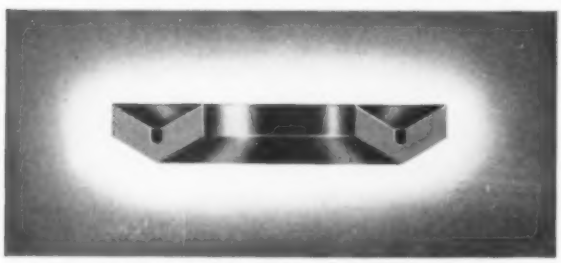


2. Sea Ring packing for rods

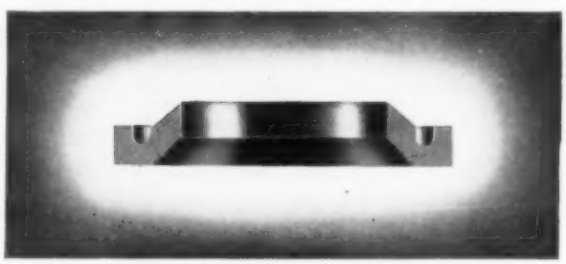


3. Uneepac Packing for rods and pistons

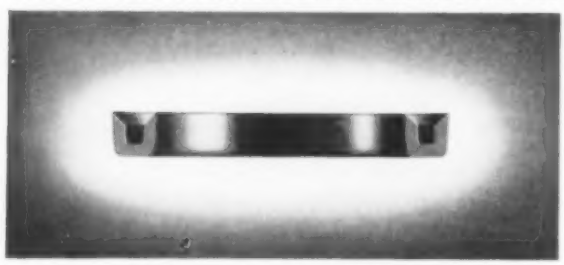
4. Hat Cup Packing for rods



5. V-Rings packing for rods and pistons



6. Cumpac #239 packing for rods



7. U-Cup Packing for rods and pistons

THE WIDE VARIETY of Johns-Manville Packing designs enables you to handle practically any sealing problem. The designs shown on this page are obtainable in a broad range of standard sizes and in materials designed for either usual or special service conditions encountered in hydraulic and pneumatic equipment. Johns-Manville also produces oil seals, moulded gaskets and miscellaneous shapes to specification. See your local J-M distributor or J-M sales office for product or engineering data. Or write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville MOULDED PACKINGS

(Above) Red-hot steel slabs, weighing over 2 tons each, are at arm's length from hydraulic lines filled with Irus Fluid 902—YET NO FIRE HAZARD.

(Right) The distinctive yellow color of Irus Fluid makes it easy to spot and trace hydraulic line leaks.

"After numerous tests, we selected Shell Irus Fluid 902 because of its excellent fire resistance and low cost,"

says Norman Bracht, Lubrication Engineer, Alan Wood Steel Company, Conshohocken, Pa.

A fire in the strip mill, causing serious equipment damage and plant down time, convinced the Alan Wood Steel Company that a switchover to a fire-resistant hydraulic fluid was imperative. After extensive testing with various commercial types, Shell Irus Fluid 902 was selected. Now . . . twelve months later . . . Alan Wood is convinced that serious hydraulic fires in strip mill tilt table are a thing of the past.

Irus* Fluid 902 is a specially compounded water-in-oil emulsion which has exceptional fire resistance. Plant tests show, time after time, that Irus Fluid 902 *actually snuffs out fire!*

Many plant operators, like Alan Wood Steel, have discovered that Irus Fluid is economical . . . costing up to one-third less than other fire-resistant fluids, yet its performance is comparable in every practical respect.

If your present hydraulic equipment is vulnerable to accidental fire hazard, we suggest that you obtain complete technical information on Shell Irus Fluid 902. Write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y. or 100 Bush Street, San Francisco 6, California.

*Registered Trademark

SHELL IRUS FLUID 902

a low-cost, fire-resistant hydraulic fluid

SHELL

USEFUL LITERATURE

For your free copy of publications reviewed, fill in the reader service card

HYDRAULICS TO 5000 PSI . . . is the subject of a condensed bulletin outlining a complete line of hydraulic pumps, motors and controls made by *Denison Engineering Division, American Brake Shoe Company, Columbus, Ohio.* Constant and variable volume pumps and motors—vane for 2000 psi, piston for 5000 psi—are shown. This literature gives the designer a quick guide to specification data sheets covering this complete line of power and control components.

CIRCLE 400 ON TIME-SAVER CARD

METAL SEALING RINGS . . . for hydraulic actuators are detailed in technical literature offered by *Koppers Company, Inc., Baltimore, Md.* Theory of sealing with piston rings is analyzed. Types of sealing rings, materials and applications are described. A comparison chart shows major operating characteristics of metallic seals and elastomeric seals.

CIRCLE 401 ON TIME-SAVER CARD

NEW PAPER CARTRIDGE FILTER . . . is described in a bulletin sheet from *General Filters, Inc., Novi, Michigan.* This AF-500-X series use a throwaway cartridge. Choice of three cartridges—5, 15 or 35 micron filtration. Curves are plotted to show gallons per minute flow vs. pressure drop across the filter.

CIRCLE 402 ON TIME-SAVER CARD

TUBE FITTINGS . . . a complete line manufactured by *Flodar Corporation, Cleveland, Ohio* is described in a new 28-page catalog. Separate catalog sections cover self-flaring fittings, no-flare fittings and flare-type fittings. Each section contains complete information on the design and installation of the particular type covered, plus detailed dimensional and engineering specifications. Information on all sizes from ⅛ to 2 inch is included. Several pages are devoted to specifications on high pressure steel pipe fittings commonly used in hydraulic systems.

CIRCLE 403 ON TIME-SAVER CARD

AIR AND LOW PRESSURE OIL CYLINDERS . . . in bore sizes of 1½ to 6 inches are detailed in literature available from *The Sheffer Corporation, Cincinnati, Ohio.* A cutaway drawing shows construction features of this C20 series of cylinders. Rated for 150 psi air and 500 psi hydraulic, the cylinders are tie rod design. Charts give complete dimensional information on foot, flange and clevis mounted designs.

CIRCLE 404 ON TIME-SAVER CARD

ROTARY AIR COMPRESSOR . . . delivering 100 hp is described in a new bulletin from *Davey Compressor Co., Kent, Ohio.* Contents include unit photos, "in-service" pictures, complete specifications and diagram illustrating the Hydrovane rotary cooled compression cycle. Unit delivers 420 cfm at 100 psi.

CIRCLE 405 ON TIME-SAVER CARD

PISTON ACCUMULATORS . . . for 2000 and 3000 psi operation, made in sizes ranging from 1 pint to 10 gallons are shown in a group of engineering drawings available from *American Bosch Division, Springfield, Mass.* Drawings provide complete dimensional data, pressure, temperature and precharge specs, along with a complete parts list. For each accumulator a gas precharge chart permits selection based on available oil volume.

CIRCLE 406 ON TIME-SAVER CARD

F-R FLUID . . . a phosphate ester compound for use in extreme ambient temperatures is described in a data sheet prepared by *E. F. Houghton & Co., Philadelphia, Pa.* The new sheet gives the physical properties of the fluid being used in hydraulic control systems in steel mills where it must regularly withstand a wide range of temperatures. The sheet gives information on paints suitable for use with this phosphate ester fluid, and recommendations for proper installation in a hydraulic system.

CIRCLE 407 ON TIME-SAVER CARD

RESTRICTOR VALVE . . . having a safety retention cap designed to prevent complete removal of the needle and blow-out of the stem is described in a new catalog sheet prepared by *Fluid Controls, Inc., Mentor, Ohio.* Sheet gives size data and flow characteristics of this adjustable flow control valve which allows free flow in one direction.

CIRCLE 408 ON TIME-SAVER CARD

VARIABLE SPEED DRIVE . . . using a pneumatic control system is described in literature from *U. S. Electrical Motors Inc., Los Angeles, Calif.* Operation and application is stressed. The system permits speed control by pressure, liquid level, humidity, tension etc.

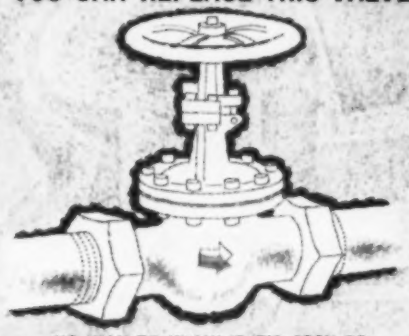
CIRCLE 409 ON TIME-SAVER CARD

AIR CONTROL VALVES . . . is the title of a 4-page bulletin issued by *Automatic Valve Co., Farmington, Mich.* These products are illustrated and detailed: J.I.C. solenoid valves, master valves, pilot valves, hand, foot, cam valves, speed control valves, air exhaust mufflers, clamping cylinders.

CIRCLE 410 ON TIME-SAVER CARD

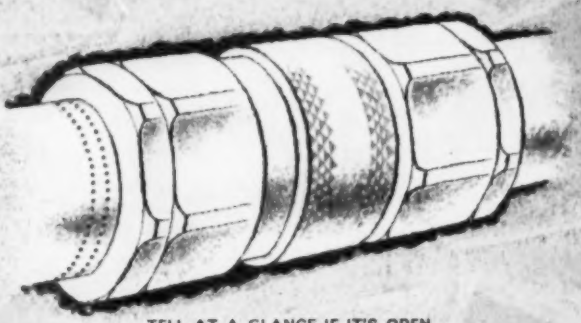
Continued on page 58

YOU CAN REPLACE THIS VALVE



NO WAY TO KNOW IF IT'S OPEN OR SHUT WITHOUT TESTING.

WITH THIS SNAP-TITE VALVED COUPLING



TELL AT A GLANCE IF IT'S OPEN OR SHUT . . . NO TESTING.

A CHALLENGING NEW CONCEPT-

AUTOMATIC VALVING

The *instant* the two halves of the Snap-Tite valved coupling are connected there is full, free flow through it. No tedious turning of wheels as in conventional valves. When you want to shut off the Snap-Tite valved coupling, you just pull back the sleeve. You can tell at a glance the line is closed.

Leakage past conventional valves is difficult to find . . . not so with Snap-Tite valved couplings! Further, Snap-Tite valved couplings take up less space. So, why not switch to Snap-Tite automatic valving? Eliminate the possibility of incorrectly set or leaking valves and save time in installation and maintenance. Investigation might show considerable savings.

Sizes ¼" to 10" of all machineable metals

For more information, write for Snap-Tite catalog and, if you wish, outline your problem. Your local Snap-Tite representative will be glad to advise you.

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

★Snap-Tite, INC.

UNION CITY | , PENNSYLVANIA

Boost production . . .
cut fatigue with
Westinghouse Air Circuitry*

***Westinghouse Air Circuitry** is the application of pneumatic control to industrial production operations — a proven method of stepping up machinery output . . . increasing operator efficiency. These pneumatic devices are low in cost . . . easy to install . . . extremely accurate and reliable.

"H" CONTROLAIR® VALVES:
3- and 4-way directional valves—accurate pressure control in small increments—hand, foot, knob, or cam operation—maximum delivery pressure: 60, 100 psi—port sizes: ⅛" ips—maximum operating temperature: 200°F.

THREE-POSITION CYLINDERS:
noncushioned—3 stroke positions—foot and swivel mounted—2"-6" in diameter—maximum operating pressure: 250 psi.

MULTI-POSITION CYLINDERS:
noncushioned—4, 5, or 7 stroke—small diameter—tough, corrosion-resistant construction—maximum operating pressure: 250 psi.

Consult your nearest Westinghouse Air Brake Distributor. He's listed in the classified phone directory under "Cylinders: Air."

Westinghouse Air Brake
COMPANY
Industrial Products Division
WILMERDING PENNSYLVANIA

USEFUL LITERATURE

12 GPM CONTROL VALVES . . . designed for directional control on mobile equipment are detailed in Catalog 1552A10 issued by *Parker Hydraulics Division, Parker-Hannifin Corp., Cleveland, Ohio.* Designed for earth-moving, material handling, agricultural and other mobile equipment, these valves can give metering control for raising, positioning, rotating, holding or lowering operation. Pressure drop curves and dimensional drawings are shown for 1-, 2-, 3-, and 4-spool models.

CIRCLE 411 ON TIME-SAVER CARD

NEW GASKET . . . called Kaobestos is discussed in spec sheets available from *F. D. Farnam Co., Chicago, Illinois.* This rubber-asbestos material is available in sheet stock in two grades of GRS, in Buna N, and in Neoprene. Spec sheet gives information on cost and performance.

CIRCLE 412 ON TIME-SAVER CARD

TEMPERATURE AND PRESSURE INSTRUMENTS . . . whose application include hydraulics and pneumatics are described in 64-page Catalog 101-A prepared by *H. O. Trerice Company, Detroit, Mich.* Separate bulletins give information on No. 730 hydraulic gagues having pressure ranges from 1000 psi to 30,000 psi. Specs for low pressure air gauges are also supplied.

CIRCLE 413 ON TIME-SAVER CARD

LOW PRESSURE CYLINDERS . . . for air and hydraulic service are described in Bulletin 25. These cylinders, manufactured by *Pathon Manufacturing Co., Cincinnati, Ohio,* come in three different series: WA which is a threaded assembly for heavy duty; UA which is a square head, universal mounting design; KA which is a less expensive tie-rod design. Complete dimensional and construction data is given for all three series. Parts lists are included.

CIRCLE 414 ON TIME-SAVER CARD

FLEXIBLE PLASTIC TUBING . . . reinforced with outer braid for hydraulic pressure applications is included in Bulletin T-97 published by *The U. S. Stoneware Company, Akron, Ohio.* Called Tygon, this material is being used in many industries. Bulletin shows properties and specifications.

CIRCLE 415 ON TIME-SAVER CARD

TEFLON O-RINGS . . . with dimensional tolerances of .001 and less are described in bulletin TR-2772 prepared by *Tri-Point Plastics, Inc., Albertson, N. Y.* These seals meet AN and MIL specs. Tables give dimensional information for both round and square section rings. Service temperatures range from minus 450 F to plus 550 F, with working pressures to 30,000 psi.

CIRCLE 416 ON TIME-SAVER CARD

FORGED STEEL GATE VALVES . . . made by *Lunkenheimer Co., Cincinnati, Ohio* are described in a 2-page circular, No. 607. Two types of valves are shown. One has screw ends; the other has socket welding ends. Each is manufactured in sizes from ½ to 2-inch for 2000 psi service at normal hydraulic temperatures.

CIRCLE 417 ON TIME-SAVER CARD

FILTERS . . . are the subject of a new 132-page engineering and application reference manual which can be obtained by writing to *Bendix Filter Division, Bendix Aviation Corp., Madison Heights, Mich.* Filters for aircraft, missiles, industrial and ground support equipment having hydraulic and pneumatic systems are detailed. One section gives a brief history of filtration, discusses particle sizes and basic filter media. Engineering specs, flow curves, capacities and sizes are presented.

CIRCLE 418 ON TIME-SAVER CARD

PIPE HANGERS . . . which can solve many hydraulic line mounting problems are shown in sheets offered by *Lowell Manufacturing Company, Inc., Kalamazoo, Michigan.* Sheets show pipe straps to handle lines from ¼ to 2 in diameter.

CIRCLE 419 ON TIME-SAVER CARD

For more reviews of FREE LITERATURE turn to page 116

Easy Money! Everybody Wins!

YOU CAN'T LOSE IN THIS BIG . . .

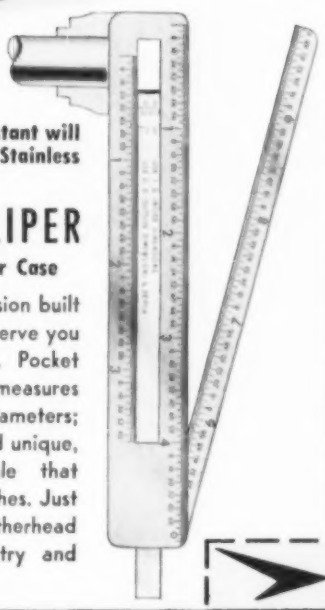
WEATHERHEAD WIN WITH ERMETO® CONTEST

SIMPLE, EASY TO FILL OUT, CONTEST FORM MAILED ON REQUEST

. . . SEE COUPON BELOW

We want the simple facts on a wide range of Weatherhead high pressure Ermeto Fitting Applications. Send for the questionnaire now. Take a few minutes to fill in and mail. You will receive the Super-Caliper as our token of appreciation—and your entry will also be entered in the $15,000.00 cash awards contest.

FREE!



You and Every contestant will receive this Quality Stainless Steel

SUPER CALIPER

In Genuine Leather Case

A high-quality precision built instrument that will serve you well for a lifetime. Pocket size—5½" long; measures inside and outside diameters; has depth gauge and unique, built-in folding rule that opens out to ten inches. Just send in your Weatherhead Ermeto Contest entry and it's yours.

$15,000.00

IN CASH AWARDS

185 WINNERS

1st Prize		$ 1,500.00
2nd Prize		1,000.00
Next 8 Winners	$750.00 each.	6,000.00
Next 35 Winners	100.00 each	3,500.00
Next 40 Winners	50.00 each	2,000.00
Next 100 Winners	10.00 each	1,000.00
Total Winners 185	Total Cash Awards	$15,000.00

CONTEST CLOSES SEPTEMBER 30, 1958

SEND FOR SIMPLE, EASY CONTEST FORM TODAY

Yes I Want the CALIPER and a Chance at the EASY MONEY

Win with Ermeto Contest
P. O. Box 2457, Fort Wayne, Indiana

Gentlemen:

Please rush simple Ermeto Contest form. I understand that my filled in form received by you entitles me to a Super Caliper and also enters me in the $15,000.00 cash awards contest.

NAME _____

STREET _____

CITY _____

STATE _____

WEATHERHEAD

FIRST IN HYDRAULIC COMPONENTS

THE WEATHERHEAD CO.
Fort Wayne Division
Fort Wayne, Indiana

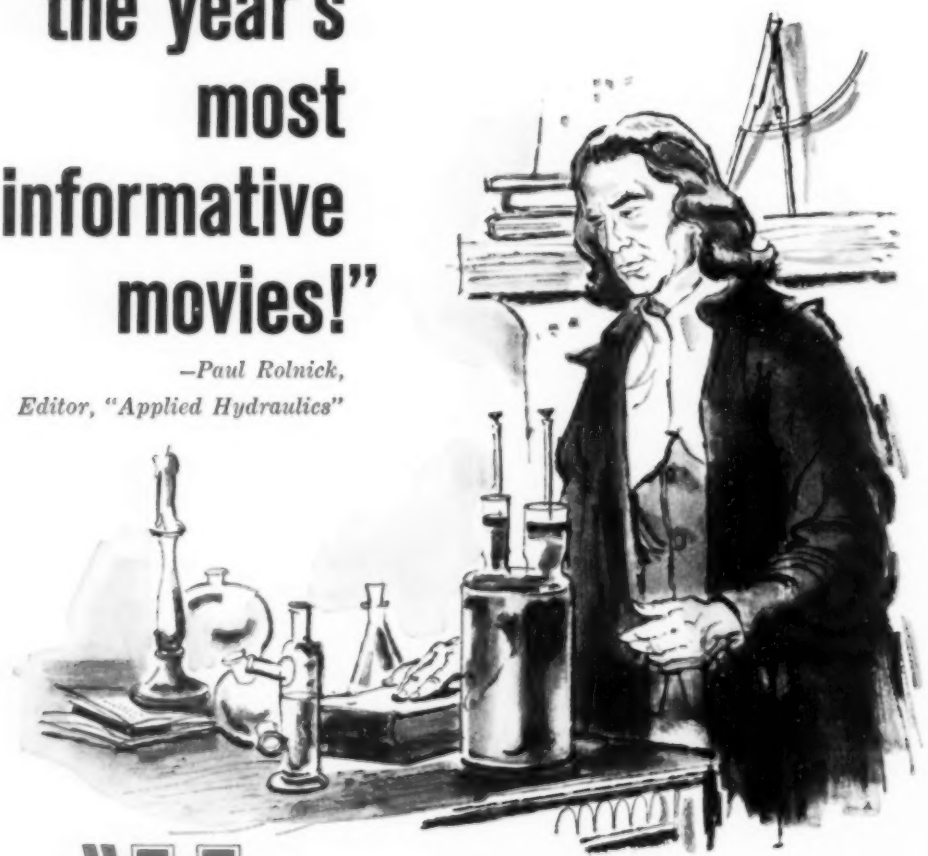
In Canada:
The Weatherhead Co., Ltd., St. Thomas, Ontario

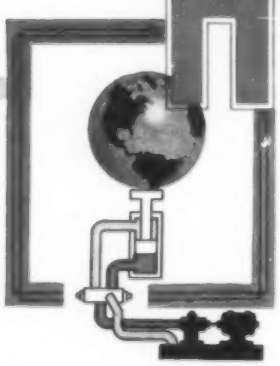
CIRCLE 115 ON TIME-SAVER CARD

★ ★ ★ ★

"One of the year's most informative movies!"

–Paul Rolnick,
Editor, "Applied Hydraulics"





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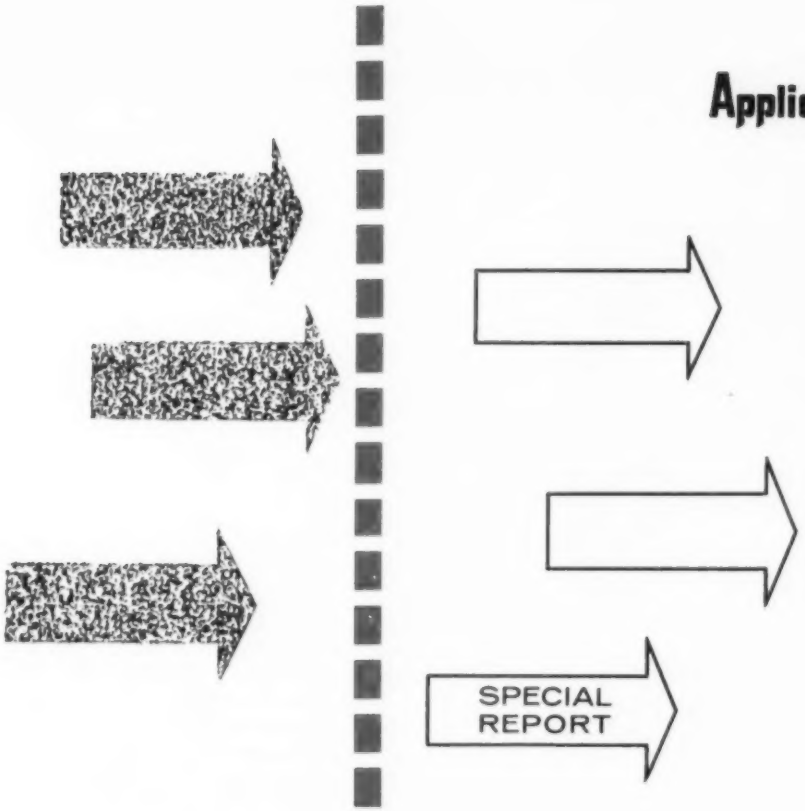
TEXACO

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL



Designing for fluid maintenance

PROBABLY the weakest link in American industrial production is machine maintenance. There's no shortage of skill in the design offices. Engineers are constantly coming up with ideas to make machines faster, more automatic, more complex . . . and more of a problem for the maintenance man.

There's no doubt that higher speeds are basic to our competitive economy, that's how you cut production costs. But are we running away from ourselves? Maintenance superintendents complain about complexity in machines, and how hard it is for their crews to keep them running. "We want good controls, designed by good engineers, but not *for* engineers," complained a plant manager in a recent design forum.

What's the answer? Better trained maintenance men: better maintenance instructions; better field service—these are all good *corrective* measures. But the real *cure* is better design. The designer has to be just as aware of how well his machine can be maintained as he is of efficiency, appearance, or performance. On the following pages you'll find what six leading designers said about keeping hydraulic and pneumatic systems clean and well lubricated, and information about selecting and applying fluid power products that help the maintenance man do his job better, faster, easier.

. . . high pressure filter for best operation

A. J. McCLELLAND,
Assistant Manager, Machine Tool Design

ROBERT F. GRIFFIN
Manager, Research & Development Laboratory

The Warner & Swasey Company

IN OUR hydraulic system for shifting gears and clutches, we have gone through considerable development to our present practice of installing filters in the pump outlet line. Formerly we put the filter in the suction line, but this brought the danger of pump starvation if the filter were not changed regularly. As filtration requirements increased, so did filter size, and a larger filter was required for very fine filtration with minimum pressure drop. Large filters are hard to get into a small reservoir that fits in with the machine.

With a 2 or 3-gpm pump requirement, pressure drop across a clean filter is about 3 psi. Since the additional pressure drop in the suction line is 3 to 5 psi, the total drop is 6 to 8 psi which is close to the limit for quiet pump operation. Therefore, the filter had to be cleaned frequently.

We have also tried bypass filtration in a tracer system requiring flows from 20 to 30 gpm, because we could not get a large enough full flow filter for the required 10-micron filtration without prohibitive cost. The filter we selected bypassed 2 gpm, and we also used a coarse suction filter. We found that we could not provide satisfactory filtration of the fluid to the servo valve and cylinder with this arrangement, and concluded that a bypass filter is not adequate for a tracer system.

Our present machines have the filter installed in the high pressure line from the pump, except for our tracer system which uses suction filtration with four filters in parallel for the 3-gpm pump. At about 25 psi, most cartridges are near clogging, and some types of cartridges may collapse when clogged, sending all the dirt, as well as parts of the cartridge, into the system. To prevent cartridge collapse, we employ a 20-psi bypass relief valve.

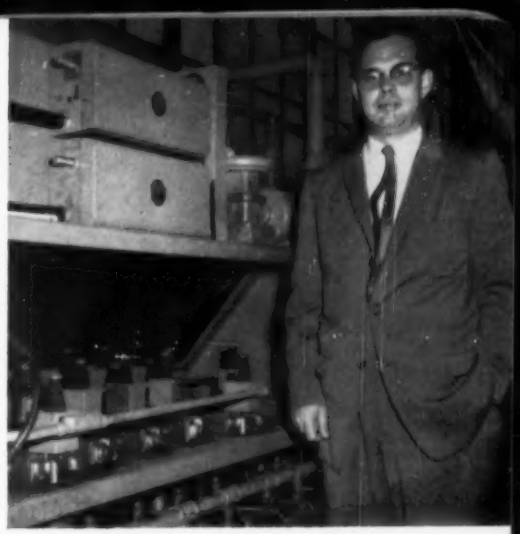
• **Filter Indicator**—Although high pressure filters have the advantage of complete filtration without danger of pump cavitation, they also raise the problem of a simple, reliable way of detecting when the filter needs replacement. When a suction filter clogs, the pump gets noisy, indicating cavitation. With a bypass filter, it is simple to install a pressure gage at the inlet side. However, a pressure indicator has to detect *differential* pressure across a high pressure filter. We would like to read an 18 psi pressure drop within 2 psi in a system which operates at 150 and sometimes 250 psi. But most pressure gages read to an accuracy of only 5 psi in this range. We feel that some type of simple mechanical indication is best, and we are now investigating a device which indicates bypass flow around the filter when pressure drop exceeds 18 psi.

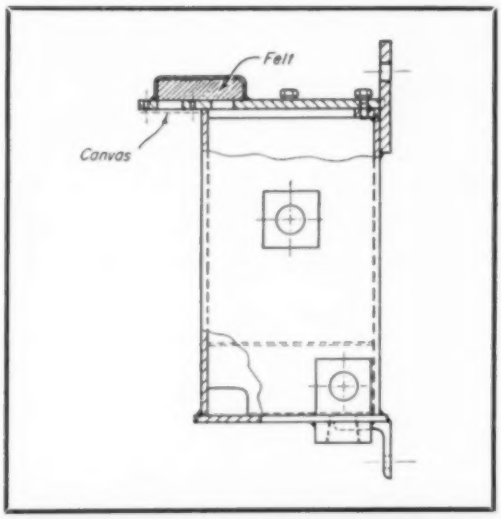
We have concluded that filtration on the pressure side of the pump is more satisfactory than suction line operation. While the container for the filter must be strong enough to take the working pressures, it is felt that the higher cost compared to a low-cost suction side filter is justified for lower maintenance. ▼▼▼

EDGE TYPE FILTER (arrow) on this heavy duty turret lathe has handle for cleaning. Because of finer filtration requirements, this has been replaced by a cellulose unit with throw-away cartridge for 25-micron filtration.

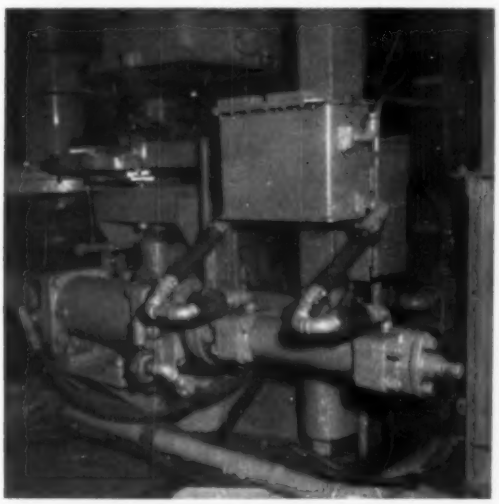
. . . design for air lubrication

E. H. BRAUER,
Chief Engineer
Osborn Manufacturing Co.

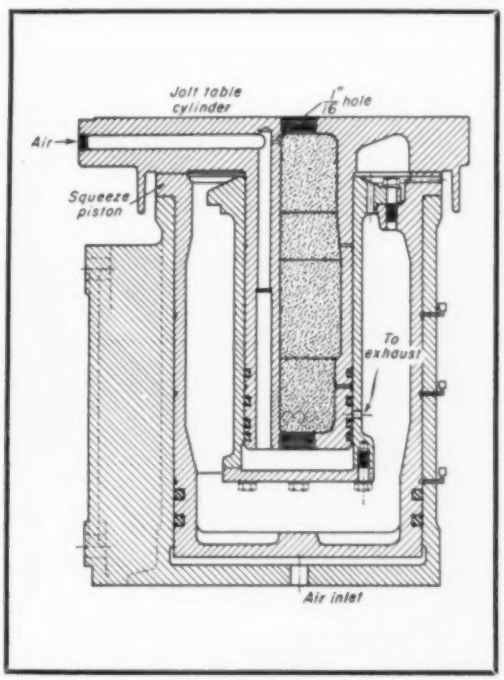




DESIGNING air-operated equipment for foundries requires special emphasis on good filtration and lubrication. Few machines must operate in so dirty an atmosphere. Since the cylinders on our machines frequently have from 30 to 36-inch bore and operate at about 500 fpm in conjunction with much smaller cylinders, a single lubricator for the air system is not sufficient. Even the use of multiple units in a system may not provide the lubrication that is needed. One lubrication design which we are using on our molding machines is shown on the diagram. The inner piston which jolts the table and mold to insure complete filling, is hollow and filled with wool waste. A plug in the



RESERVOIR FOR AIR-OIL tandem cylinders has opening protected by felt or canvas to keep out dirt. Metering valves in lines from cylinders to reservoir control air cylinder speed.



CONCENTRIC HOLLOW PISTONS actuate Osborn's machine for filling flasks. Lubrication is by pressurized wool waste in the inner cylinder and through grease fittings for the outer cylinder.

table permits daily oiling. A 1/16-inch hole drilled from the pressure line to the inside of the piston, provides a slight pressure on the inside of the piston, so that oil is forced out to the grooves. The outer piston has three grooves turned on its OD. Holes through the outer cylinder with grease fittings permit daily lubrication of the outer piston which gives the final squeeze to pack the sand.

To keep dirt out we use boots on valve actuators and cylinder piston rods. We feel that having boots on the manual operated valves and on the manual override of solenoid valves is excellent, and would like to see more manufacturers come out with this feature. Boots on cylinders have the disadvantage of drawing in dirt and trapping it if they are punctured. ▼▼▼

. . . sacrifice appearance for access

P. E. FORSTER,
Chief Engineer

Motch & Merryweather
Machinery Co.

THE production supervisor does not stand back and admire the appearance of a machine tool, but he is certainly interested in the accessibility of components and their life and maintenance requirements.

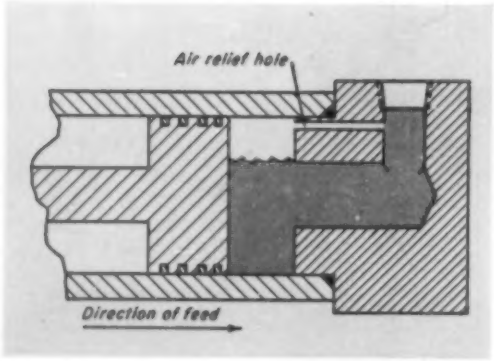
On many of our hydraulically operated machines, we install both a suction strainer and a proportional type bypass filter. Make-up oil is often contaminated with dirt and chips from buckets, funnels, and other handling equipment. The filler strainer traps some dirt, but we also provide a suction strainer to protect the pump and valves.

The bypass filter catches fine particles and oxidation products which are produced during system operation.

A pressure-compensated flow control valve meters ¼ gpm to the filter. The pressure-compensated feature gives a fixed flow regardless of system pressure. The fullers earth and cellulose cartridge in the filter removes oxidation products such as acids, gums, resins, asphaltenes, as well as solid particles.

Much hydraulic servicing is caused by clogged suction strainers. This causes pump cavitation resulting in noise, reduced pump delivery, and a slower machine cycle. Too often the strainer is never cleaned. We are now considering a suction strainer that mounts on the outside of the reservoir. There is a window in the strainer case for visual inspection and a relief valve to bypass fluid when a pressure difference across the strainer rises to a fixed value.

• **Air Bleeding**—Air trapped in hydraulic cylinders causes spongy action. When we build cylinders for fine, smooth, tool feeds, we attempt to have the cylinder port on the top of the cap. We drill a small hole in the end cap to release the entrapped air. This is necessary for slow feed cylinders that do not bottom at the end of the stroke. Where we cannot have the ports out of the top, we pipe a bleed hole in the cylinder wall to a petcock at an accessible location. ▼▼▼



AIR RELIEF HOLE permits expulsion of air from cylinder when piston does not bottom in cylinder.

. . . better reservoirs

NORMAN CONRAD, Superintendent of Maintenance

GERALD SNOWDEN, Superintendent of Hydraulic Maintenance

Ford Motor Company, Cleveland, Ohio

WE HAVE a regular maintenance program of checking and replacing filters, adding make-up oil, and cleaning reservoirs, but there are many things which would make our job easier. Although most filters connected in a bypass circuit have a gage to measure back pressure, these are easily broken, and we prefer a plug connection so that a maintenance man can make the rounds regularly with a portable gage.

Pumps should not be mounted directly on the reservoir cover, because dirt enters through the mounting holes. We prefer access covers which seal with a gasket to those which have an O-ring, because the O-ring is harder to install. An air breather with a sintered element is more rugged than one with steel wool. Drain holes for the reservoir should be at least 18 inches off the floor so that it is easy to use a bucket.

We prefer activated earth type bypass filters which we have in addition to suction filters which remove the larger dirt particles. We've seen tests to show that a contaminated system was cleaned in 48 hours operation with a bypass filter. Although there is some removal of additives with activated earth filters, this is not appreciable.

We take pains to keep dirt out of make-up fluid. Oil coming into our plant by tank car is stored in underground tanks and pumped to points throughout the plant. From there it is pumped into sealed trucks and taken to the individual machines for filling. These trucks are cleaned every 3 to 6 months. ▼▼▼

filter comments . . .

• Bypass filters vs. periodic cleaning

". . . the continuous bypass filtration system far outweighs any advantages of periodic cleaning of the system. It's automatic, it's cheaper because it doesn't require any labor, and it's more effective because its continuous. A full flow filter is even better where it can be used."

W. KASTEN, Bendix Skinner.

• Prefers full-flow filtration

"We don't favor the bypass filter, instead we use a full-flow filter. Also, we have filtered around all needle valves, so that the needle valve has a filter on either end. . . . We have established a periodic cleaning schedule, depending on the location, when these filters should be cleaned."

W. M. LEWIS, Pacific-Semiconductors

• Bypass protection

"As an indicator or safety measure on bypass filters, a built-in relief valve should be provided on the filter case, for protection in case of clogging. A pressure switch or other mechanism could also be used."

J. E. MERKLE, Ford Motor.

• Filtering FR fluids

"Fire resistant fluids frequently act as detergents and remove a lot of materials that may have been lying dormant in a system formerly using petroleum fluid. This explains the short life of the first filters for systems which have been converted to fire resistant fluids."

C. R. SCHMITT, E. F. Houghton

"In general, both with water base and the non-aqueous fire resistant fluids, the methods of filtration commonly employed with petroleum oils are satisfactory. However, you may not be able to use as dense a filter medium with the water base fluid as you can with the petroleum oil, because of clogging due to the detergent action."

R. Q. SHARPE, Socony Mobil Oil

• Filtering for servo valves

"Because of the close tolerances required for optimum operation of servo valves, micronic filtration is a must. Friction and wear are the arch enemies of good servo operation. Various types of filters can be applied for this purpose, but we prefer the replaceable cellulose element type."

S. A. BJORKLUND, Rockford Machine Tool.

These remarks are from discussion at a Vickers' Production Machine Tool Hydraulic Forum.

Products for fluid maintenance

WHAT components keep hydraulic and pneumatic machines working well? Filters and conditioners to keep oil clean, filters and lubricators for air systems, bleeder devices to get air out of oil systems, and reservoirs designed to settle out dirt, keep fluid power systems working well year after year. You can learn about many representative types on the following pages.

To select the right oil filter, the engineer must ask himself where is the best place to install it, how much fluid it must pass, what degree of filtration he needs, and what impurities he wants to filter.

How much fluid the filter must pass depends on where it is installed. Sump type filters connected in the pump intake line must be sized liberally to pass the pump requirement without starvation, even when the filter needs changing. To get the necessary volume, these may be connected in parallel, but size becomes a limiting factor with the filters in the reservoir. A smaller filter can be used in a bypass system, but many maintenance men question the value of this kind of filtering, because it does not keep the system as clean as full flow filtration. High pressure filters in the pump output line must also pass full pump delivery, but they eliminate the danger of pump starvation. They are probably the filters of the future, and will undoubtedly become more popular.

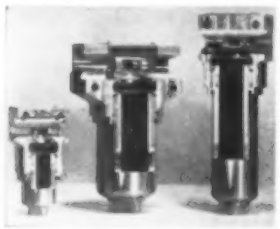
The degree of filtration depends largely on the machine. Servo valves in hydraulic tracer systems may require filtration to 10 microns, but many machines with standard valves and cylinders work well with a 100-mesh, screen type suction filter.

OIL FILTERS AND CONDITIONERS

Filters can be classified as depth, edge, absorbent, and adsorbent. Here are representative types.

STAINLESS STEEL ELEMENTS

• **Design**—Folded woven stainless steel element eliminates breakage of wires at folds and maintains uniformity



of openings. Wire cloth of different porosity backs up element to improve drainage and filtration. Stainless steel metal edge, porous metal units and a Micronic unit for finest filtration are also available. For high temperatures and extreme vibration, stainless steel end caps are silver brazed to the wire cloth element. Otherwise aluminum end caps are cemented to the element.

• **Specifications**—Wire cloth has size ratings of nominal 2 to 35 microns, which correspond to absolute ratings of 13 to 50 microns. Flow rates for the wire cloth elements range from 0.5 to 29 gpm. One series of inline filters rated at 12 gpm is rated at 1500, 3000, and 5000 psi. With 12 gpm of 75-SSU fluid, pressure drop across a 5-micron, wire-cloth element is 5 psi. *Purolator Products, Inc., Rahway, New Jersey.*

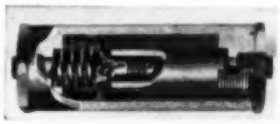
HIGH PRESSURE IN-LINE

• **Design**—Available in 5-12, 12-25, 25-50, 50-125, and 150-200 micron size.

Made in brass and stainless steel. Furnished with ⅛, ¼, ⅜, or ½ in-pipe threads. Maximum operating pressure of 5000 psi. ⅜ in. filter with 50-125 micron element has pressure drop of less than 7 psi at 10 gpm. *Hoke, Inc., Englewood, N. J.*

10-MICRON INLINE

• **Design**—10 or 40-micron elements available and interchangeable in same



housing. 3000-psi filter can mount in any position. Filter elements replaced without breaking connections. With MIL-0-5606 fluid, pressure drop is 8 psi at 6 gpm, 20 psi at 10 gpm. Built-in relief valve prevents crushing the element because of dirt accumulation and excessive pressure drop. It opens to bypass filter element at 75 to 80 psi. ⅜-inch filter weighs 2 lb. *Waterman Engineering Co., Evanston, Ill.*

FILTER GLOSSARY

ABSOLUTE RATING—Smallest particle which a filter will stop 100%.

ABSORBENT FILTER—Filter in which fluid is soaked through element such as felt, cotton, or paper.

ADSORBENT FILTER—Filter in which dirt is collected on surfaces of filter medium such as Fullers earth, activated alumina, charcoal.

ASPHALTENE—A product of oil oxidation.

BACKWASH—Cleaning a filter by reversing flow through it.

BYPASS—Filter arrangement which passes only part of pump output. Filter is usually connected from pump output to tank.

CAPACITY—Amount of contaminant which a filter can hold before it offers too high a resistance to fluid flow.

CARTRIDGE—Usually a replaceable filter element.

CONTAMINANT—All foreign material in the fluid, such as dirt, oxidation sludge, water, air, chips.

DEPTH FILTER—Filter in which fluid flows through long winding passages in material such as sintered metal, porous ceramic.

DESICCANT—Drying agent used in air filters to remove water vapor.

DIFFERENTIAL PRESSURE—Pressure drop across a filter. Shows how full the filter is.

EDGE FILTER—Filter in which surface presented to fluid is nearly flat, such as wire mesh or disk.

ELEMENT—Part of filter which collects contaminant and can be removed for cleaning or replacement.

FULL FLOW—Filter arrangement in which all system fluid passes through filter.

FULLERS EARTH—A soft clay which removes oxidation products from oils.

MESH—Measure of fineness for wire screen. 100-mesh is common size; width of openings are 141 microns.

MICRON—Measure of particle size, equal to .0000394 in. 25 microns equal approximately .001 in.

NOMINAL RATING—Particle size which will be largely (about 95%) removed by filter.

PROPORTIONAL FILTER—Unit which passes all system fluid but filters only part of it.

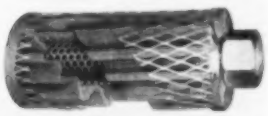
RESISTANCE—Restriction which a filter offers to fluid flow. Depends on filter size and how full of contaminant it is.

SINTERED METAL—Filter element in which metal particles are bonded together under heat and pressure without passing through a liquid phase.

STRAINER—Usually a wire screen element placed in the reservoir and connected to the pump suction line.

SYNCLINAL WIRE MESH

• **Design**—Has large active filtering area with minimum flow restriction. Sump, line type, and in-line filters are made for fire resistant fluids—both aqueous and synthetic as well as for



petroleum base. Sump type filter has reinforced synclinal insert, base and perforated centering tube, expanded metal protective cover, top cover and coupling. Washers separate covers from insert.

Line type filter has outer housing which is unscrewed by hand nut to remove filter element. To clean, the insert is removed and circulated in a caustic solution, then blown dry with compressed air.

• **Specifications**—Sump type units range from ¾ in pipe size to 3 in for flows of 5 to 100 gpm. Pressure drop across 5-gpm unit with 225-SSU oil is 187 psi, and across 100-gpm unit it is .078 psi. Standard filter elements are 100-mesh Monel, but other meshes can be supplied from a coarse 30-mesh to a fine 200-mesh.

Line type units range from ¾ in. to 2 in. for 5 to 50 gpm. They are also made for 75 and 100 gpm. *Marvel Engineering Co., Chicago, Illinois.*

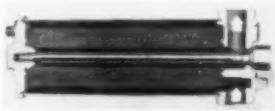
5000 PSI FILTER

• **Specifications**—Element will take 3000-psi differential without collapse and is made in 5 to 250 micron sizes. It can be cleaned and reused indefinitely. Bowl is knurled for easy hand tightening and removal. Housing is made in aluminum or stainless steel with AND 10050-4 inlet and outlet pressure taps. Filter can be furnished with a red flag indicator to tell when it is

clogged. The ¾-inch size has a capacity of 12 gpm and the 1-inch, 24 gpm with MIL-0-5606 hydraulic fluid. *Bendix Filter Division, Bendix Aviation Corp., Madison Heights, Mich.*

FIBER CARTRIDGE

• **Design**—Element is fiber felted and impregnated with resin and bonded by heat. Fiber density is graded, so that as fluid passes from outside to inside of cartridge, filtration becomes finer.

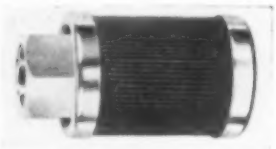


• **Specifications**—Standard filter housings made in stainless steel, cast iron, bronze, and brass. Capacities range to 500 gpm for oil and 1000 gpm for water at pressures to 5000 psi. For high pressures, housings are all-welded construction and can be made to hold 200 cartridges. Special built-in cartridges are made for original equipment manufacturers to build into pumps, valves and hydraulic reservoirs. Elements in 10, 25, 50, and 75-micron sizes are 85 to 90% porous giving high flow rates with low pressure drop.

• **Application**—Unit is for full flow filtration, and is located on pressure side of pump, close to equipment to be protected. A low pressure relief valve will maintain flow if filter clogs. *Cuno Engineering Corp., Meriden, Conn.*

SUMP TYPE

• **Design**—One piece construction, no screws to loosen. Filtering media is 60 mesh Monel wire screen re-inforced by Monel. Top and bottom made of stainless steel. Being noncorrosive, filter can be used with any hydraulic oil or



fire-resistant fluid. Small size makes it adaptable in reservoirs where space is limited. Made in pipe sizes to 3-in. and capacities to 125 gpm. 20-gpm unit has a pressure drop of 0.15 psi at rated capacity. *Capital Engineering & Mfg., Corp., Chicago, Ill.*

GAGE INDICATOR

• **Design**—By-pass filter with gage tells when element needs changing. Gage mounted on unit reads pressure drop across element. When needle reads in the red area element is dirty. Filter has a capacity of ¼ gpm. *Century Hydraulics, Inc., Detroit, Mich.*

PERMANENT MAGNET

• **Features**—Magnetic separator. Removes ferrous particles; designed for full flow with low pressure drop. Fluid enters at lower magnet, flows inward through channel, upward through magnetized grids, and out through upper magnet. Magnetized edges of grids break up stream, forcing each particle close to grid edges. Strong,

convergent magnetic field holds particles on grids until filter is cleaned. Grids also catch lint fibers. Unit is cleaned by opening it and removing grid which is then demagnetized. Washing grid with solvent removes chips; magnets are wiped clean.

• **Specifications**—Units for aircraft are rated at 3000 and 5000 psi to pass 6 and 12 gpm. With MIL-0-5606 fluid, pressure drop with 12 gpm is 9 psi, with 120-mil openings, 52 psi with 5-mil openings and 16 psi with 11-mil openings. *S. G. Frantz Co., Trenton, N. J.*

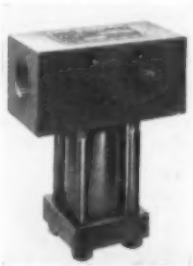
INTEGRAL RELIEF, FULL FLOW

• **Design**—Pressure ratings to 2000 psi. Flip top and 2-bolt caps allow easy element change without breaking connections. Choice of elements available from 3 to 40 micron and capacities up to 150 gpm calculated at 4-psi drop with 200-SSU oil. Base manifold

includes full volume relief valve, in and out porting, and optional orifice for partial filtration. Maximum temperature rating 275 F. Companion indicator shows when element is clogged. *Schroeder Bros. Corp., McKees Rocks, Pa.*

PROPORTIONAL FLOW

• **Operation**—As fluid flows through filter, part is diverted into cartridge chamber. Remainder passes through venturi throat. Increased velocity through throat creates reduced pressure which draws fluid through cylindrical element and back into main line. Suspended particles remain on cartridge,



and heavy particles settle into removable dirt trap. Works with flow in either direction. No bypass valve is needed, because maximum pressure built up across filter cartridge is controlled by venturi design.

• **Design**—Throw away filter cartridge, removable from bottom, has mesh cloth covered with a plastic and chemically treated wood cellulose. Stiff metal spring in cartridge prevents collapse under pressure.

• **Specifications**—Removes 99% of particles from 5 to 10 microns and all those larger than 10 microns. Corrugated cartridge walls have over 150 sq in of filtering surface. Model with ¾-in. pipe connections is rated for 20 gpm, with 1¼-in. connections for 50 gpm. A 125-gpm unit has either 2-in. pipe threads or connections for 2⅜-in. tube. *Vickers, Inc., Detroit, Mich.*

ALLOYED BRONZE

• **Design**—Primarily for aircraft rocket, and missile applications, alloyed bronze elements are made from millions of microscopically graded spheres. Also available with stainless steel wire mesh elements. Magnetic filter trap and automatic shut-off can be provided. Shut-off seals filter inlet and outlet when sump is removed. Permits servicing with only a minimum of air entering system. This air can be bled off through plug in filter assembly, preventing oxidation of fluid.

• **Specifications**—Alloyed bronze models are rated from 2 to 40 microns with absolute particle size cut-off guaranteed as low as 15 microns. Wire mesh

filters are rated from 5 to 175 microns. Both types have high resistance to temperature extremes, physical shock, and vibration. Temperature range is —325 F. to 700 F. in bronze; —325F to 1200 F. in stainless. Both tested at 119 G shock and 2000 cps vibration without damage. *Permanent Filter Corporation, Los Angeles, California.*

WIRE CLOTH AND MAGNET

• **Design**—Basket type element is fabricated from perforated metal with holes as small as 1/64 in. in brass and 1/32 in. in monel metal and stainless steel. This is then covered by fine metallic mesh filter cloth. Available with magnet inserts. Hand screw holds cover on, and top access permits easy cleaning.

• **Specifications**—Filter area ranges from 10.6 sq. in. in the ¼-in. pipe thread size to 296 sq. in. in the 6-in. size. Standard pressures up to 125 psi. For higher pressures of 400 and 600 psi, stud and nut closures are provided. *The Kraissl Co., Hackensack, N. J.*

SIGNAL FOR CLEANING

• **Design**—Cartridge is spring loaded against differential pressure. As dirt builds up, pressure rises and cartridge moves toward a bypass position. Also actuates a needle indicator showing whether filter is clean, needs cleaning, or is bypassing. Indicator shows that cleaning is necessary before the bypass

position is reached. This prevents passing unfiltered fluid in the system. Cartridge can also actuate a limit switch to sound an alarm, light a warning lamp, or shut down machine. Used as a suction filter, unit is mounted outside reservoir for easy maintenance. Units for return line and pressure line use are also made. All full flow filters, they are rated from 5 to 200 gpm. Cartridges are available in mesh sizes of 60, 100, 200, 325 and 50 x 250; and in felt for 20-micron filtering. Subplate mounting similar to valves is a feature of a new line of filters for flows to 60 gpm, filtration to 20 microns. They are for full flow at pressures to 3000 psi. Panel mounting gives good visibility of the cleaning indicator and simple cartridge replacement. *The Rosaen Co., Hazel Park, Mich.*

LAMINATED DISC

• **Design**—Filter element is made by stacking fiber discs. Each disc is stamped out with the same pattern and rotated 45 degrees from adjacent disc. This gives filtering area much greater than area of container. Oil flows

from outside to inside of stack. Removes particles as small as 2 microns. Will absorb 2¼ times its original weight before replacing. Maximum operating temperature is 375 F.

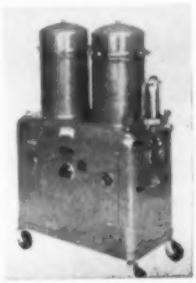
Fiber discs remove acid-forming contaminants, won't affect oil additives. Have built-in by-pass relief valves.

• **Specifications**—125 psi unit has threaded connections from ¼ to 1¼-in. or flanged connections from 2½ to 5-in. Flow capacity at 3-psi pressure drop ranges from 0.3 gpm for smallest cartridge to 139 gpm for largest. This is with 300 SSU fluid.

3000-psi type available for ¾ to 1½-in. NPT connections, and for AND 10050 boss connections. Elements replaced without removing piping. Filtering surface ranges from 169 to 3100 sq in. The 1½-in filter handles 38 gpm or 300 SSU oil with a 10-psi pressure drop. *Wm. W. Nugent & Co., Inc., Skokie, Ill.*

PORTABLE CONDITIONER

• **Features**—Used independently of regular fluid circuit and has own pump. Oil enters through visual strainer which shows when oil has been completely cleaned. A valve controls oil flow through conditioning chamber. A slow rate of flow gives maximum cleaning with a single pass through the unit. Bypassing the conditioning chamber completely permits transferring clean oil from storage to the machine, or disposing dirty oil or recirculating and flushing.



• **Specifications**—Four types of filtering media: Fullers-earth, inert paper, felt, and sintered bronze. Sintered bronze elements recommended for fire-resistant fluids. Micron sizes of elements are 2, 5, 10, 20, and 30. *Mayhew Products Co., Los Angeles, Calif.*

STACKED WAFERS

• **Design**—Monel screen wafers nest together and are held with a stud and wing nut. This eliminates an internal tube. Filtering is done on underside of wafers with larger pieces of dirt settling down the sides. This can be flushed through a bottom cleanout plug, makes disassembly seldom necessary. Entire filtering area can be cleaned. Pressure drop is minimized by diverging entrance passage which reduces fluid velocity as it changes direction to enter filtering

area. Passages through filter are sized for best flow characteristics. Filter assembly alone can be used for sump applications.

• **Specifications**—Filter assemblies from 8 to 21 wafers give flow rate from 5 to 20 gpm with inline units. Assemblies for sump installation have as many as 22 wafers for 75 gpm. *Ripley Manufacturing Co., Crosswell, Mich.*

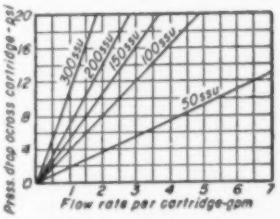
CONTINUOUS CONDITIONER

• **Design**—Unit consists of two sections, one a filter, other a vaporizer. Completely self contained with own

pumps, heaters, and controls. Oil is pumped into filter tank where fullers-earth cartridges remove acids and contaminents. Then passes through preheater into vaporizer. A 26 to 28-in. Hg vacuum is kept in the vaporizer for moisture removal. Made in capacities to 600 gph. *Hoffman-Allen Corp., Springfield, Mo.*

CELLULOSE CARTRIDGE

• **Design**—Filter contains removable cellulose packed cartridge. Fullers earth cartridges also available. They are standard size; can be used in multi-

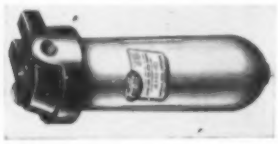


ples where greater capacity is needed. Cover assembly includes relief valve, cartridge hold down spring, air vent, and tightening stud. Portable filters also available. Selected to circulate oil approximately four times per day. Maximum flow rates are 0.5 gpm for fullers earth and 1 gpm for cellulose cartridge.

• **Specifications**—Unit has a maximum operating pressure of 60 psi, and 1-inch NPT inlet and outlet ports. Graph shows pressure drop at various viscosities and flow rates for one cellulose cartridge. To determine capacity of filter, multiply flow rate by number of cartridges. *The Hillard Corp., Elmira, N. Y.*

HONEYCOMB FILTER TUBES

• **Design**—Honeycomb filter tubes of cotton, nylon, orlon, dynel, acetate or glass fibers provide depth filtration. Fluid is filtered through hundreds of filtering films. Elements available for



removal of particles down to 1 micron. Compact container units rated for pressures up to 4000 psi. *Commercial Filters Corp., Melrose, Mass.*

PLEATED PAPER

• **Design**—Simple, rugged construction permits pressure ratings of 250, 1000 and 3000 psi for installation between pump and control valves. Unit withstands shock and vibration. Quick coupling on cover gives fast installation of refills. Can be furnished with built-in relief valves, connections for air

bleeder valve or pressure gage. Connections are ¾ in. to 1½ in. and give high flow rate with low pressure drop across filter. *Briggs Filtration Co., Washington, D. C.*

WIRE WOUND ELEMENT

• **Design**—wire with 20-micron spacing is wound on perforated metal cylinder, covered with filtering cloth that will retain particles to 2 microns. Will withstand extremely high pressure drop without collapse. *Auto-Klean Strainers, Ltd., Hounslow, England.*

VERSATILE FILTERING UNIT

• **Features**—Portable, capable of four filtering operations: 1. Discharging filtered oil from reservoir to external source, 2. Pumping and filtering oil from external source where no pressure is available, 3. Receiving and filtering oil from external source where pressure

is available, and 4. Circulating and filtering within unit itself.

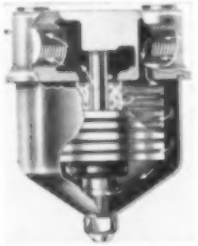
• **Specifications**—Unit is mounted on hand cart 40 x 20 x 37 in., and has 80-gallon reservoir. Rating of 5 microns absolute and ½-micron nominal retention; will handle 400 to 800 gal of oil before replacing element. Pump for filtering unit has a rating of 10 gpm at 60 psi. *Greer Hydraulics Inc., Jamaica, N. Y.*

AIR FILTERS AND LUBRICATORS

Clean air, well lubricated, means longer service from valves and cylinders. Select from these components to keep maintenance low.

METAL DISCS

• **Features**—Operates at high temperature. Easily cleaned by washing in solvent. Disc-type design gives large filter area since air passes through both sides of the disc. Also gives low initial pressure drop.

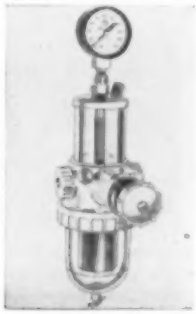


• **Design**—Discs are stacked on perforated center tube; each separated by a metal spacer which lets air enter from top and bottom. Assembly is bolted to head casting by retainer rod. Outer steel shell is bolted to the bottom of this rod. Petcock in shell allows draining.

• **Specifications**—Standard elements for 20 to 246 microns. Special felt media gives efficiencies over 95% on particle sizes down to 1 micron. Made in sizes from ¼ to 1½ in. NPT. *Air-Maze Corp., Cleveland, Ohio.*

THROW-AWAY CARTRIDGE

• **Features**—Filter, lubricator, and regulator mounted in one housing to



eliminate interconnecting piping. Lubricator has a venturi feed action. Air enters plastic cylinder oil reservoir through center tube, equalizing pressure in oil chamber and in air line. Fog mist oil is injected into air stream. Quantity of oil is controlled by pressure differential caused by air velocity through venturi.

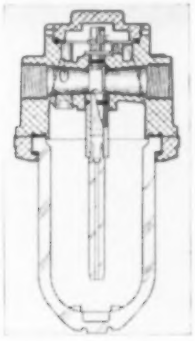
Pressure regulator is balanced piston type. Automatic bleedoff permits reducing pressure without bleeding the downstream line.

• **Specifications**—Filter has replaceable type cartridge made in 10, 25, and 40-micron sizes. Bowls are made in both plastic and aluminum for pressures to 200 psi. Made in pipe sizes ¼ to 2-in. *Perfecting Service Co., Charlotte, N. C.*

TAMPER-PROOF LUBRICATOR

• **Features**—Powl can be filled without shutting down air line. With fill plug removed air pressure is cut off to the bowl. Tamper-proof concealed adjustment easily reached once fill plug is removed. Adjustment controls position of vane in orifice to increase or decrease pressure drop when more or less oil is wanted. Feed control rod

meters oil through multiple openings breaking it up into tiny droplets for uniform dispersal in air stream.



• **Specifications**—Sizes ⅛ to 1 in. for pressures to 150 psi and temperatures to 120 F. *Hannifin Co., Division of Parker-Hannifin Corp., Des Plaines, Ill.*

DOUBLE BAFFLE FILTER

• **Design**—In-line filter, regulator, and lubricator makes a compact combination with the regulator operating in an inverted position. Filter has a double

baffle for moisture separation and a porous bronze element for particle removal. Lubricator also uses a porous bronze wick. *Gardner-Denver Co., Quincy, Ill.*

TWIN BAFFLE

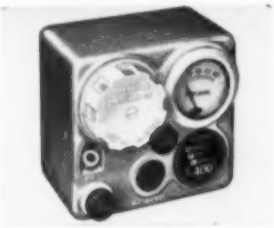
• **Design**—Two baffle plates cause centrifugal circulation of incoming air and force water and dirt particles to base of reservoir. Smaller particles that

may be still in the air, are held by filter element. Unit has no moving parts and requires no adjustment. Can be taken apart for cleaning without removing piping.

• **Specifications**—Available in 5, 10, 25, and 40-micron sizes, for ⅛, ¼, ⅜, and ½-in. sizes. ½-in. has a minimum flow of 12 cfm and a maximum of 30 cfm. *The Bellows Co., Akron, Ohio*

COMPACT THREE-SOME

• **Features**—Regulator, filter and lubricator are mounted in one case suitable for panel mounting. Regulator is



piston type with long travel for accurate pressure regulation. On the front is pressure gage, lubricator adjustment knob, filler plug, and oil sight glass. Filter is a replaceable ribbon type. Inlet and outlet ports are ½-in. NPT. *Logansport Machine Co., Inc., Logansport, Ind.*

LOW PRESSURE DROP

• **Features**—Large ribbon type filter element keeps pressure drop low. Easy to dismantle for cleaning. Large petcock permits fast removal of harmful material.

• **Specifications**—Maximum operating pressure 150 psi, burst pressure 500 psi. Made in ⅛ to ¾ in. pipe sizes. Pressure drop at 100 cfm and 80 psi in the ⅛ to ½ in. size is 3 psi. In the ¾ in. unit at 180 cfm and 80 psi the drop is 4 psi. Particle size removal 40 micron. *Gits Bros. Mfg. Co. Chicago, Ill.*

REPLACEABLE METAL BOWL

• **Features**—Filters with automatic drain handle pressures to 250 psi and temperatures to 200 F. With manual drain 250 psi and 300 F. Uses directional louver principle for removal of

moisture and a screen or sintered metal element for particle removal.

• **Specifications**—Made in pipe sizes ¼, ⅜, ½, ¾, and 1 in. Available with choice of three fiter elements. A 74-micron, 200 mesh, reinforced Monel wire screen, and 64 and 25-micron sintered metal elements. Permanent metal bowl filters are made in ¾, 1, 1¼, and 1½ in. with a 74-micron filter screen and a manual drain. *C. A. Norgren Co., Englewood, Colo.*

FOG LUBRICATOR

• **Features**—Small venturi section gives lubrication at flow rates of less

than 1 cfm. A by-pass gives lubrication at high flow rates with low pressure drop. A ball check prevents oil return to the reservoir when air flow is stopped, providing instant lubrication when air flow starts. *Watts Regulator Co., Lawrence, Mass.*

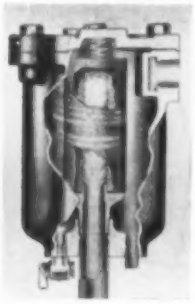
UNIT TYPE

• **Specifications**—Made with ¼-in. female NPT inlet and ⅛-male outlet.

Filter is for low air flows on pneumatic tools. Can be taken apart for cleaning or replacing felt sleeves. Housing is aluminum and adaptor is brass. *Tru-Flate, Inc., Oakland, Calif.*

POROUS STONE

• **Features**—Two stages of separation, first centrifugal and second diffusion. Inlet nozzle directs air in whirling motion. Water, dust, oil, and pipe scale thrown against inner wall are trapped



in slots which drain to bottom. Air is then discharged through a porous stone tube. Element is not absorbent and not effected by water or oil.

• **Specifications**—Made in ⅜ to 4-in. size for 150, 300, and 500-psi. 4-in. unit will handle 700 cfm of air at 80 to 125 psi.—*R. P. Adams Co., Inc., Buffalo, N. Y.*

FILL UNDER PRESSURE

• **Features**—Designed for use where there are many lubricators feeding air tools or cylinders. An oil supply line

is piped to each lubricator which are filled under pressure. It is not necessary to shut off air pressure to fill. Can be operated at different pressures if needed. Lubricators have only one moving part. *Wilkerson Corp., Englewood, Colo.*

POROUS BRONZE ELEMENT

• **Features**—Curved inlet passage directs air in a helical centrifugal pattern which throws out moisture and large particles. Dry air centrifugally cleaned passes through cone shaped porous bronze filter element. Shape of the element gives large filtering area.

• **Specifications**—Made in 20 and 40-micron size. Pressure 150 psi for plastic bowl and 250 psi for metal bowl. Sizes from ¼ to 1 in. NPT. *Watts Regulator Co., Lawrence, Mass.*

SEPARATOR-FILTER

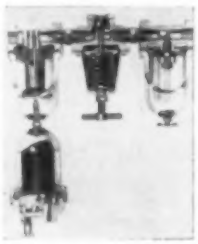
• **Operation**—Air enters the unit at a tangent causing a whirling motion Moisture is removed at this point by centrifugal force. Condensation that has been slammed against the walls of the separator drains to the trap below and is ejected automatically. Air then

rises up through the desiccant chamber where final traces of moisture are removed. Desiccant can be easily replaced when indicated by color change.

• **Specifications**—Made in ¼ to ¾-inch pipe sizes. *Jas. A. Murphy & Co., Inc., Hamilton, Ohio.*

SINTERED BRONZE

• **Features**—Air is filtered through a sintered bronze element to remove pipe rust, scale and dirt. A system of baffles removes up to 98% of free



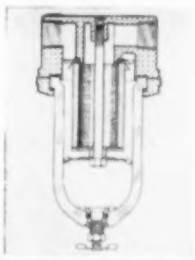
moisture which is collected, and automatically ejected by the drain trap.

The regulator gives accurate pressure regulation to prevent waste of compressed air.

A fine spray mist of oil is then introduced into the air stream to lubricate cylinders, valves and air tools. Made in pipe sizes ¼ to 1 inch. *Arrow Tools Inc., Chicago, Ill.*

EDGE-TYPE FILTER ELEMENT

• **Features**—Oversized air passages for unrestricted flow. Air deflector plate sets up cyclonic action for oil, moisture, and particle removal. Lower baffle plate reverses air flow stilling air below so contaminants remain trapped. Large ribbon-type element gives edge-filtration to remove finer particles. Element is plastic impregnated and not effected by moisture or solvents.



• **Specifications**—Will remove particles down to 40 microns. Bowls rated at 150 psi and 120 F. Made in pipe sizes from ¼ to 1 in. *Hannifin Co., Division of Parker-Hannifin Corp., Des Plaines, Ill.*

FOR 3300 PSI

• **Design**—Pneumatic filter for 3300 psi rated at 10 microns. Filter element can be replaced without disturbing piping. Weight, ½ lb. *Walter Kidde & Co., Inc., Belleville, N. J.*

WHIRLING ROTORS

• **Features**—Compressed air revolves 4 multi-bladed rotors at high speed. Moisture and dirt are hurled by centrifugal force to outer tapered rims of rotors, and to inner wall of filter.

Out of the air stream contaminants flow down into the sump.

• **Specifications**—Aluminum rotors turn on oil-sealed stainless steel ball bearings. Housing is cast iron. Made with threaded pipe connections from ¾ to 2-in. and flanged connections 3 to 10-in. *Logan Engineering Co., Chicago, Ill.*

Fluid power from three pumps in tandem works independently or in combination

Three COMMERCIAL heavy-duty pumps are the heart and mainspring of the fluid power system in the Warner-Swasey Hopto excavator. Mounted on one common shaft, they deliver from a single drive the power which helps to make the Hopto one of the fastest, most powerful hydraulically operated excavators in the world.

Each of the three direct-mounted tandem pumps supplies the power for one of the three separate oil hydraulic systems. This assures full power on every action. Separate drives for each pump are eliminated. Installation of the tandem pump is clean. All three pumps take up little more space than one single pump. Savings in installation costs are obvious. And, when an extra power reserve is needed in one of the hydraulic systems, by simple valving the output of more than one pump can be combined. The Hopto takes full advantage of the COMMERCIAL tandem pump features. The three hydraulic systems work like this.

Power Used Independently—at a pump speed of 1800 rpm and relief valve pressure setting at 1500 psi—involves pump delivery of 40 gpm, 30 gpm and 30 gpm respectively into three pressurized circuits. Circuit number one powers the 360° swing of the Hopto and operates its dipper stick. Both the boom and bucket are powered by the second circuit. The third circuit delivers power for the Hopto's stabilizers.

Extra Power Requirements needed for excavating in hard ground are no problem. Power from the pump on the stabilizer circuit is tapped and combined with that of the dipper stick's pump. This power reserve enables the Hopto to dig where other machines fail.

A 20-ton push on the dipper stick is thus generated without the need for an oversized pump or the waste of prime mover horsepower.

Precision Tool Control at all times is a sure result with fluid power transmission. Just one example—no other kind of power transmission could provide such sensitive down-pressure on the tool. Varied operations like digging, swinging, lifting and loading are fast and accurate when oil hydraulics is the power transmitting media. Such multi-functional operations always respond to the precise command of the operator with a minimum of effort on his part.

Fluid power transmission, in contrast with mechanical power transmission, involves fewer wearing parts. It is free of elements which cause vibration. Combined with the outstanding performance of COMMERCIAL pumps, fluid power transmission makes possible the kind of lower maintenance, reduced down-time, and lower operating cost advantages Warner-Swasey offers in its Hopto.

We'll Cooperate Fully with you in designing your fluid power system—pumps, valves, motors, cylinders. Send details of your problem to Commercial Shearing & Stamping Company, Dept. A-31, Youngstown, Ohio.

COMMERCIAL
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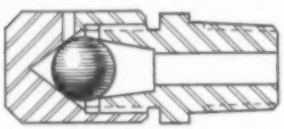
CIRCLE 25 ON TIME-SAVER CARD

AIR BLEEDER VALVES

Air entrained in hydraulic fluid causes poor feed, cavitation, and suction failure. This air rises to the highest point in the system and can be removed by bleeding off through a valve at that point. These valves were designed for this job.

BALL VALVE

• **Design**—Bleeding is done by backing off cap of bleeder valve while system is under pressure. This allows ball to unseat releasing trapped air in the



system. As soon as a solid stream of oil flows through the hole in the valve cap, the cap is tightened. Pressure rating is 5000 psi; threads are ¼-in. pipe. *Rivett Lathe & Grinder, Inc., Brighton, Mass.*

CONTROLS DISCHARGED FLUID

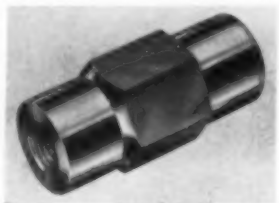
• **Design**—Discharge port of this valve can be turned 360° and locked in any position to direct bleed flow in tight locations. A clear plastic tube on the discharge prevents any splatter and also shows when system is completely free of air. 1½ turns of bleed screw gives full flow, so there is no

tendency to open it too far. Discharge control feature is especially important on missile launching and other equipment where oil puddles create a fire hazard.

• **Specifications**—Standard material cadmium-plated steel, but other materials can be supplied. Test pressures are 3500 psi operating, 7000 psi proof, 14,000 psi burst. Temperature range is —65 F to 280 F with standard O-ring. Nozzle is $\frac{7}{16}$-in. OD, threads are $\frac{7}{16}$ - 24 UNF. *Fluid Regulators Corporation, Painesville, Ohio.*

PUMP PRIMING

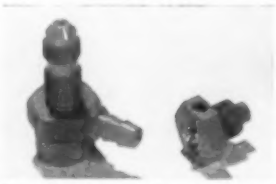
• **Application**—Air in hydraulic circuit can prevent the pump from priming when it is connected with a closed center valve or with another pump. When the pump is operating against pressure in a blocked line, air in the system may not be compressed sufficiently to escape through the relief valve even though this is vented. Therefore the pump cannot prime. In a dual pump circuit where both pumps supply one system through check valves, pressure can build up in one pump outlet and prevent air from escaping through the opposite check. The second pump will not prime. The bleeder valve is teed into the pump



discharge line and remains open as long as it passes air. When all air has been bled, the initial surge of hydraulic fluid closes the valve, and it remains closed until there is air in the system. *Denison Engineering Div., American Brake Shoe Co., Columbus, Ohio.*

TWIST OR PUSH

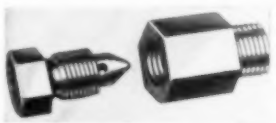
• **Design**—Two valve types permit bleeding by either twisting or pushing the cap, depending on access in mounting. In twist type, cap is rotated until bleeding is completed. Spring-loaded cap closes the valve when released. Push type is opened by pressing the cap. A spring returns the cap and closes the valve when bleeding is completed. Valves are now standard in seven military aircraft, three missiles, and in various ground support equipment.



• **Specifications**—Valves meet MIL-V-5523B and are tested for zero leakage to 3000 psi and are suitable for use to 400 F. Twist type is made of aluminum; push type is made of aluminum or stainless steel. Miniature valve is .82 in. long, weighs .25 oz. *Arkwin Industries, Westbury, New York.*

CENTER DRAIN HOLE

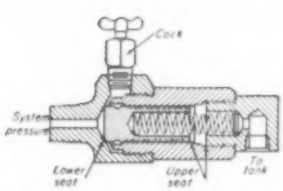
• **Features**—Only two metal parts make up this valve, and no packings are used. Cross hole through shaft con-



nects with hole through centerline of shaft. When valve is loosened and unseats, air and oil bleed out top. *Logansport Machine Co., Inc., Logansport, Indiana.*

BLEEDS DURING TRAVERSE

• **Application**—Valve is specifically designed for fine feed applications to bleed out air during rapid traverse and when the slide is idle. Since oil is not bled during feed, controlled speed is not affected. Valve has other applications on linear and rotary drives.



• **Operation**—When system pressure exceeds 20-psi, the plunger raises off its lower seat. Air-oil then follows the spiral grooves around the plunger, and back to tank. When system pressure rises to 125 psi, the plunger seats against its upper seat closing off flow to tank. The petcock is normally closed and opened only when filling the system. The valve is installed at the highest point in the system. The photo shows the valve installed directly on a pump. *The Oilgear Co., Milwaukee, Wisconsin.*

Continued on page 76

NEW

LINE OF QUICK-TOP FILTERS
READY FOR SERVICING
IN 25 SECONDS

(ONLY A SCREW DRIVER IS NEEDED)

First of its type available . . . applicable for hydraulic missile and machinery requirements . . . this unit developed and manufactured by our Test Equipment Division features

- Temperature range: —65 to 200° F.
- Standard 10 Micron AN elements .2 Micron available on special request
- Flow rate of 15 to 90 gpm . . . pressures up to 10,000 psi
- Differential pressure indicator available with in-line Micronic, Quick-Top, Micro-Magnetic models

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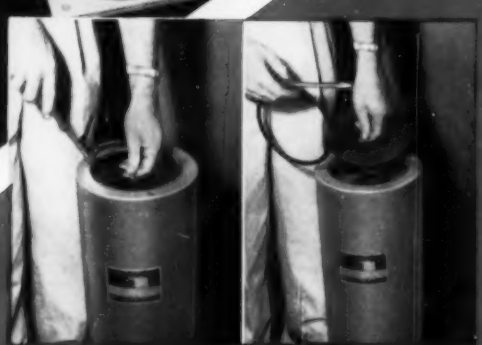

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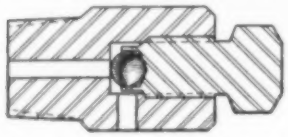
0 TO 10,000 PSI RANGE

• **Application**—Designed for bulkhead type installations, valve conforms to all applicable military specifications. It is also made for industrial non-bulkhead installations. It is opened without tools by twisting the control knob. Releasing the knob, spring closes the valve.

• **Specifications**—Burst pressure is over 25,000 psi and operating pressure is to 10,000 psi. Standard valve is for 5000 psi. 10,000 psi operation also available. Opening torque is 5 in-lb at 5000 psi. Weight is 1 oz. Temperature range is —65 to 275 F for MIL-0-5606 fluid, water, gas, or fuel. Material is aluminum, except for stainless steel ball and seat. *Greer Hydraulics, Inc., New York International Airport, Jamaica, N. Y.*

BALL VALVE

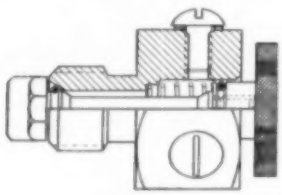
• **Design**—Hex head screw holds ball on seat to seal this valve. Loosening screw allows air and oil to bleed off.



Unit is made in ⅜ and ½-inch sizes. Overall height of the valve is 2⅞ inches. *Hydraulic Power Div., The Hydraulic Press Mfg. Co., Mount Gilead, Ohio*

O-RING SEALING

• **Design**—A contact seal at the inlet port and a sliding seal on the valve



stem prevent leakage in this valve. Three outlets permit selecting the most convenient discharge port. Push type valve cannot be left open to permit fluid to be pumped out of the circuit. A positive stop at the inlet port allows system pressures to 3000 psi, but the valve is recommended for actual bleeding at pressures to 100 psi. *James, Pond & Clark, Inc., Pasadena, California.*

"Air in hydraulic systems is in two forms: dissolved in the fluid and as suspended bubbles. The suspended air is the most troublesome, because it affects the bulk modulus of the fluid. This shows up mostly in servo systems. Increased air content reduces the stiffness of the system, and this produces instability. With increasing air content, the bulk modulus of an oil is non-linear, particularly in the lower pressure range.

An increase in the bulk modulus of the fluid increases the pressure build-up time. In high speed working, this can be a considerable disadvantage."

D. Firth, Principal Scientific Officer, Mechanical Engineering Research Laboratory, Glasgow, Scotland.

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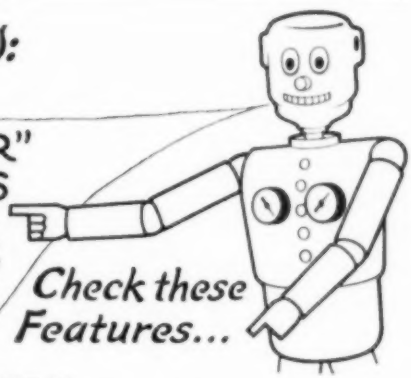

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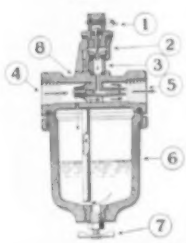

1. TAMPER PROOF OR HANDY ADJUSTMENT.
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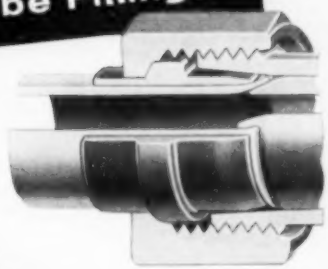
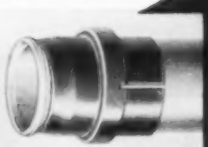
FLODAR Self-Flaring Tube Fittings





- Eliminates flaring, threading and soldering.
- Cannot be damaged by over-tightening.
- "Rock-bottom" stop signals that joint is sealed.
- Provides positive, leak-proof seal.

One piece chrome-moly patented steel sleeve forces the tube end into the connector body automatically forming a pressure-tight seal on both the OD and ID of the tube. The slotted rear of the sleeve grips tube against vibration.

■ FLODAR self-flaring tube fittings eliminate time-consuming preparatory operations such as flaring, brazing, welding or soldering. Tubing costs are reduced because heavy wall tubing is not needed to assure a good joint. Even inexperienced assemblers can make a leak-tight joint every time.

Tube shearing and work hardening are eliminated . . . FLODAR Self-Flaring fittings can be reassembled time after time without fear of leakage and damage to tube and fitting.

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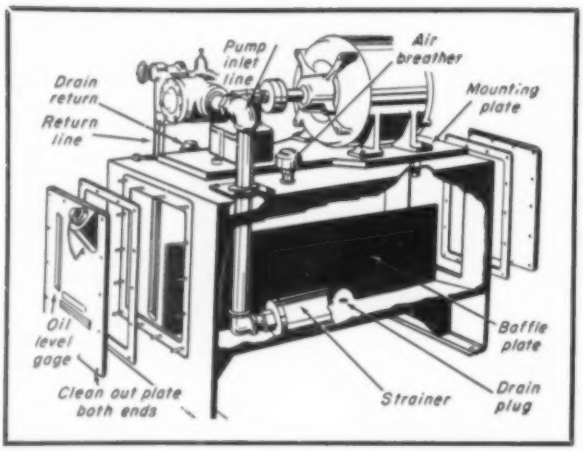
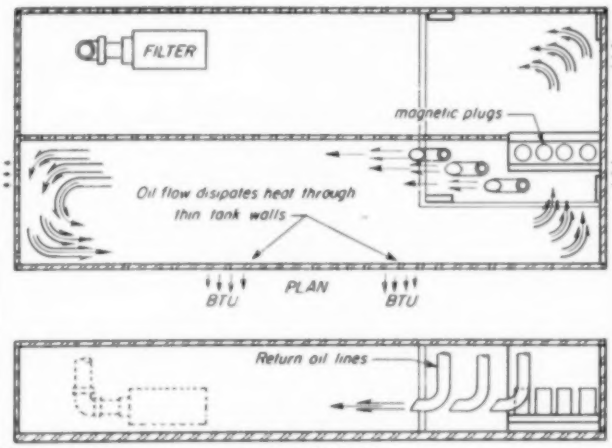


1 Courtesy Vickers, Inc.



2

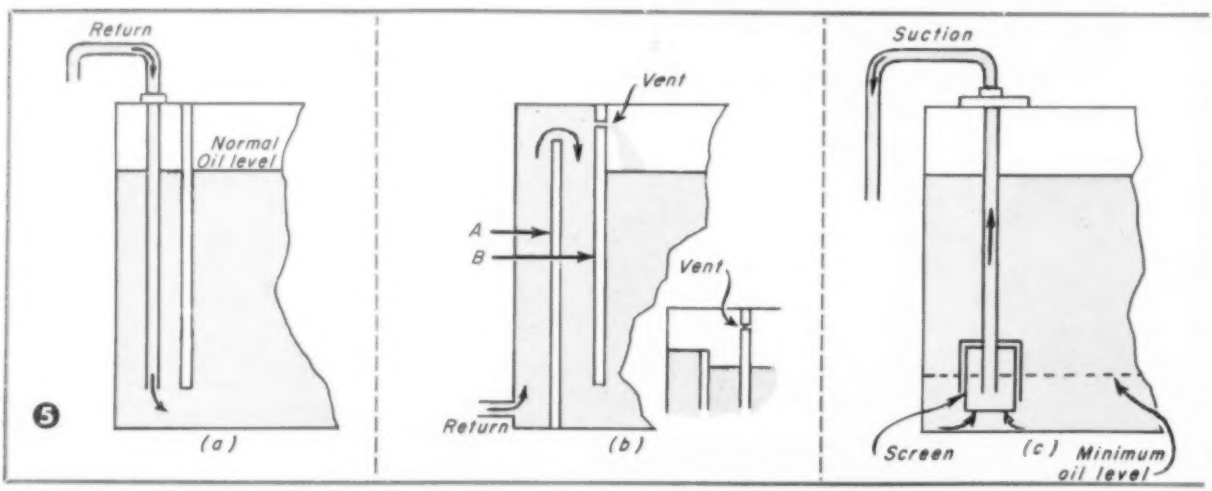
1 JIC reservoir is raised off floor for access to drain plug in dished bottom, has large covers at both ends for easy cleaning. Filler hole has replaceable, fine mesh screen, air vent has filter type breather cap. Baffle plate separating pump inlet from return gives slow fluid circulation to settle out dirt and allow entrained air to escape. Lines into reservoir have packed flanges to keep out dirt and make filter removal easy.

2 Design of the return tubes directs oil along baffle and sides of reservoir. Magnetic plugs are installed on channel in a semi-weir in line with baffle. Channel upright aligns with baffle blocking flow of particles which settle on bottom of tank.

3 Access doors and fluid level gage are located on one face of the reservoir. On smaller size units, doors should permit reaching all parts of tank. On larger units all areas should be visible for cleaning with additional equipment. Reservoir floor is inclined $\frac{1}{8}$ to $\frac{1}{4}$ inch toward drain. Tank has connection for portable oil conditioner or filter.

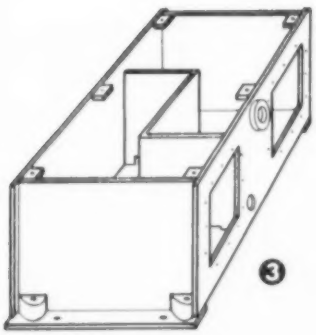
4 Baffling in this reservoir directs oil around periphery for cooling and settling out dirt. Three sludge dams in baffles screen out dirt. Adequate access for cleaning sludge dams must be provided.

5 These four reservoirs designed for mobile equipment permit removing lines from tank without draining it. Two designs at left are for return line connections. Others are for suction lines. Design (a) is used



5

trap dirt



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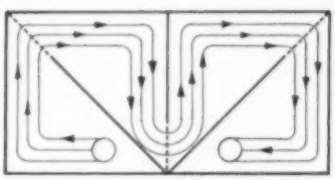
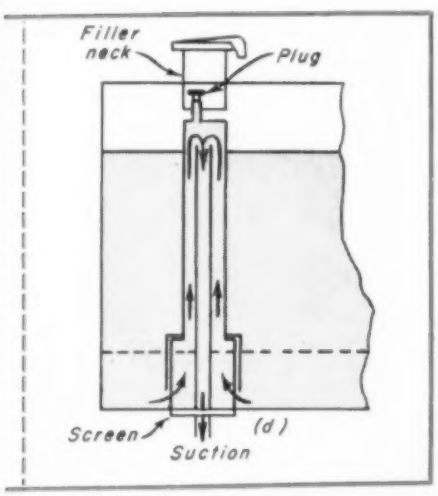


❹

on trucks where valve is mounted on top of tank. In (b) baffle *A* prevents loss of fluid from its right. Vent breaks siphon when removing return line. When suction line in design (c) is broken, siphon breaks and oil runs back into tank. On design (d) suction line is removed by first opening plug to break the siphon.



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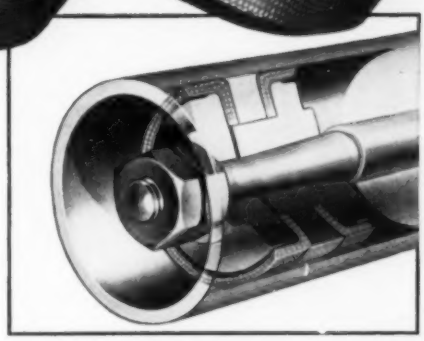

Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

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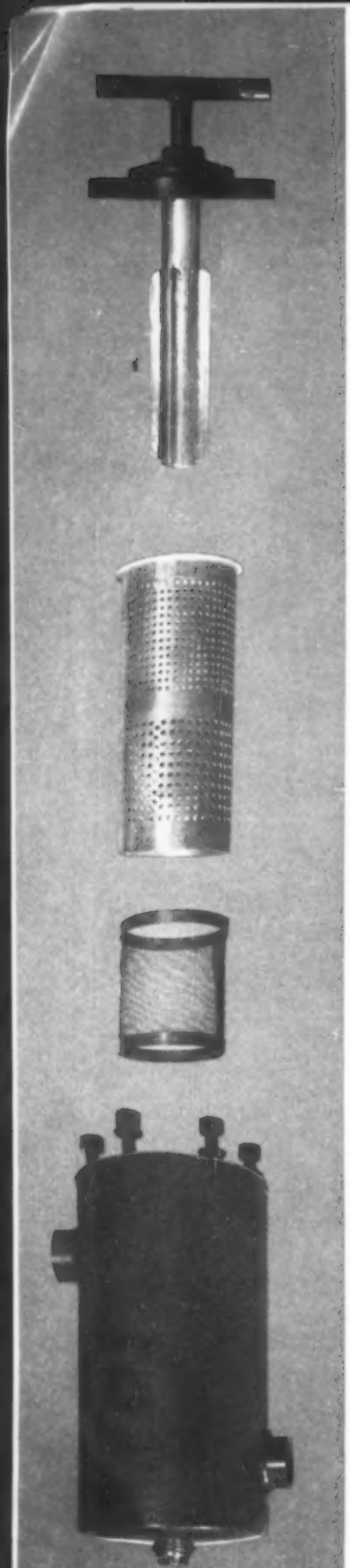


Magnetic Filter

• By Jean Thoma, *D. Sc., Zurich, Switzerland*

THE reason why magnetic filters are effective in hydraulic systems is that on sliding or rolling parts of bearings, cylinders, valves etc., at least one member is usually iron or steel. During normal wear, steel and non-ferrous particles usually break off together from the rubbing inter-face, and are held together by molecular forces. The particles are about 70% iron or steel and 30% other metals, carbon, lint, or other material. While this may be surprising, it is explained by the molecular forces which bring suspended particles together in much larger pieces.

• **Filter design**—The permanent magnets in the filter, designed by Professor Hans Thoma, are located in the central tube which is attached to the cover. The cover has a handle to permit screwing it into the outer housing. The central tube is the magnet filter core.

The fields built up near the wall of the housing by the central magnetic core are weak, so these zones are closed to the fluid stream by the tubular diaphragm arranged concentrically with the magnetic filter core. The magnetic system is enclosed in a brass tube having a smooth surface. This permits cleaning by simply wiping this tube without using compressed air. After cleaning, the magnetic core and the tubular diaphragm are again assembled into the housing.

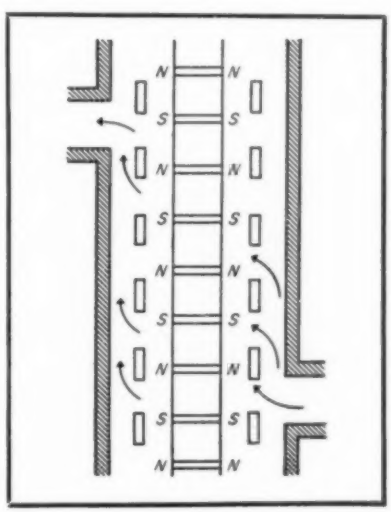
• **Separating Action**—Principal obstacle of the magnetic particles moving to the poles is the viscous friction of the particles in the fluid. This friction force is proportional to the diameter of the particle, while the magnetic forces are proportional to the volume or the cube of the diameter. Therefore it is harder to separate smaller particles. Large impurities such as welding residues which are very damaging to hydraulic systems, are eliminated easily. It is preferable to slow down the fluid as much as possible with little turbulence, and the fins in the filter are effective in eliminating circular secondary currents.

One objection made to magnetic filters is that the particles which become detached have become permanently magnetized. However, they are actually less harmful then since they will cling to iron walls and do not deposit on sensitive, non-ferrous surfaces.

• **Modifications**—For large deliveries, several magnetic filtering cores can be installed in parallel in a common housing. When there are large quantities of impurities, a ring can be placed around the filter core. This may be operated from the outside to strip the impurities into a special chamber at the bottom of the housing without disassembling or interrupting the operation.

For very dirty fluids, the filters can be constructed with a revolving drum. The magnetic core revolves slowly and a fixed scraper continually strips off the impurities which fall into a special chamber. The filter should be cleaned every 20 to 200 hours depending on the condition of the system. The actual cleaning requires only about 45 seconds.

The life of these filters is unlimited, because standard models are made without any movable parts, and the ceramic magnets used do not lose their magnetism. ▼▼▼



FILTER COMPONENTS are outer housing, magnetic core, tubular diaphragm.

CROSS SECTION DIAGRAM of filter. Ceramic magnets having *N* and *S* poles are in the central magnetic core.

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VICKERS New ¼" Temperature and Pressure Compensated FLOW CONTROL VALVE

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  Constant feed rate throughout entire cycle because built-in pressure hydrostat automatically compensates for load changes.
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  Greater flexibility because valve is adjustable within entire flow range of 5 to 1000 cubic inches per minute.
- **REVERSE FREE FLOW AS STANDARD FEATURE**
  A standard feature which permits reverse free flow (up to 1400 cu. in. per min.) from outlet to inlet port by-passing control elements.
- **TAMPER-PROOF ADJUSTMENT**
  Retension of original feed rate is assured because a set screw prevents inadvertent throttle movement and a cover over the set screw can be locked in place.
- **INTERCHANGEABLE**
  This new valve replaces 12 previous models and it is interchangeable with all of them, also the drain connection is eliminated on the new valve to simplify piping.
- **GREATER ECONOMY**
  No need to stock several valves for wide range of flow rates. Drain connection is eliminated, piping costs are reduced.
- **MAXIMUM RELIABILITY AND ACCURACY**
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

How a maker of die castings reduced maintenance by changing from mineral base oil to water-glycol fluid

F-R fluid gives a cleaner system

• By Samuel Haas, *Maintenance Engineer, Electric Storage Battery Company, Philadelphia*

WE DIE cast the lead grids for storage batteries on a machine that hydraulically clamps the die halves under 250 tons and then hydraulically injects the molten metal. Fire resistant fluids are widely used in diecasters, because their open flames and pots of molten metal are apt to ignite flammable fluids. Our plant, happily, hasn't been burdened by losses from fluid fires. However, we were interested in fire protection, but also wanted to save money, and we thought water-glycol fluid would do it.

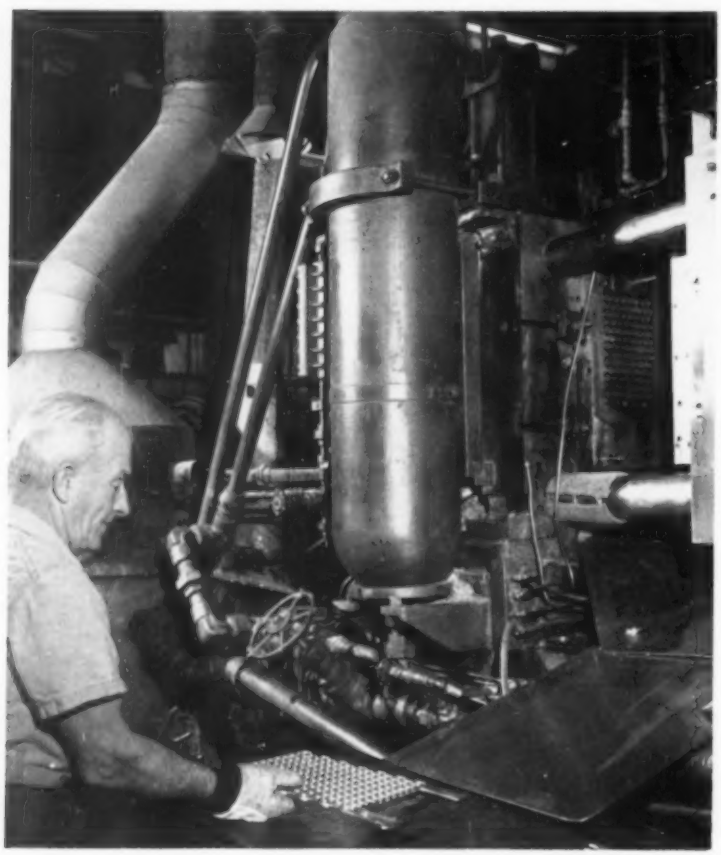
Mineral oil—such as we were using—oxidizes and forms sludge. Most settles in the reservoir, but some gets through the intake screens into the system. Every 14 months we changed oil, and the job took the diecaster out of production for half a day.

All that changed in January '55. After flushing the system, we put in the water-glycol. The diecaster then was two years old and had its original packings, which we didn't have to change, because the new fluid was fully compatible with them. After 3 years and 4 months on the new fluid we're still using it. In all that time, we've had to add only a quart of make-up monthly. We haven't had to change the fluid or do any maintenance work other than to measure the viscosity.

• **Cleaner System**—Naturally we wondered how the inside of the machine looked. Recently we got the chance to see. The machine was shut down and drained to test another fluid. There was no significant oxidation, and the dust, which usually accumulates in a hydraulic reservoir, was floating on top. Had it been mixed with oil, the dust would have become a catalyst and would have formed sludge. However, the fluid entering the intake screens in the bottom of our reservoir was always clean.

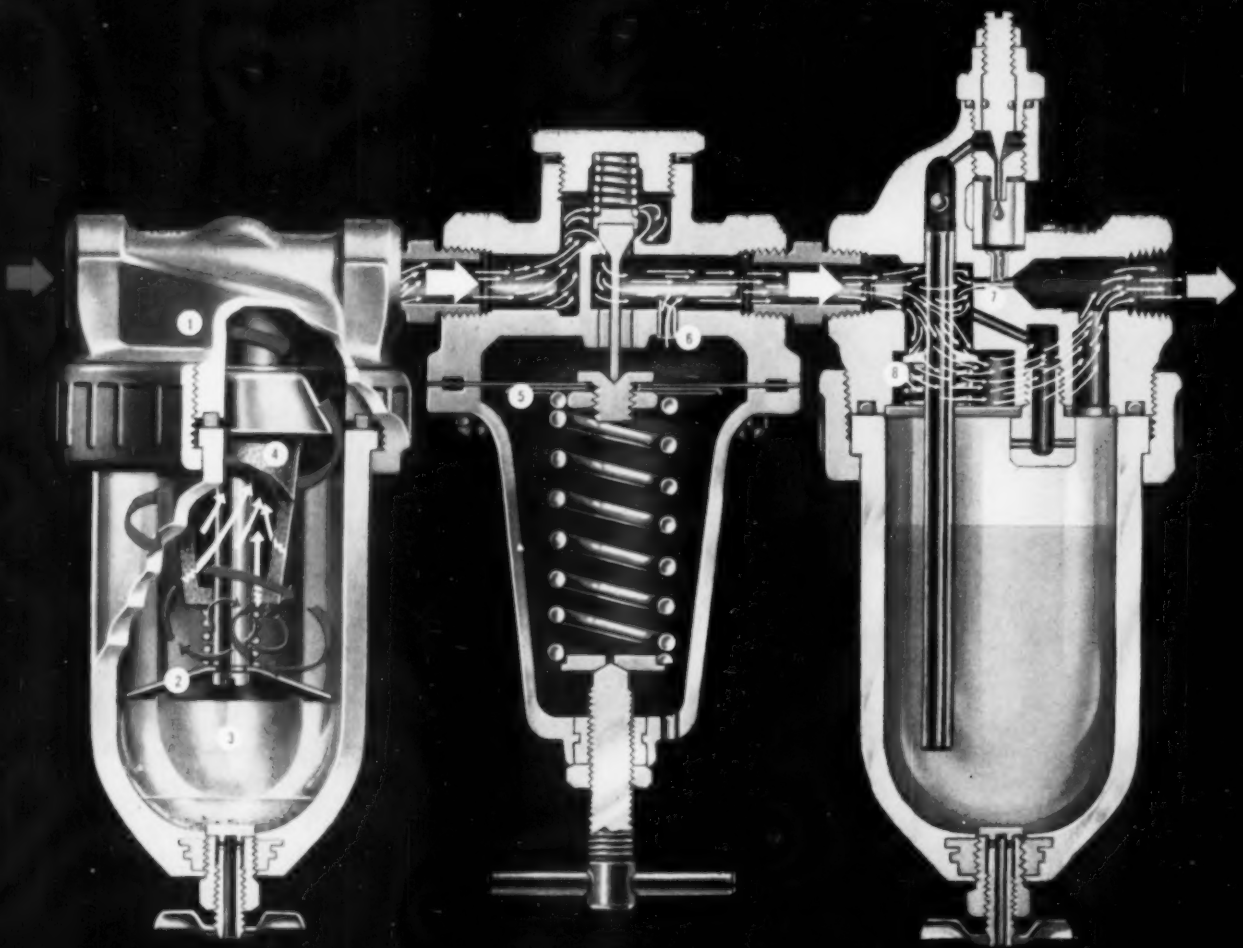
When we opened the hi-lo combination pump, we found the vanes and rings completely free of rust and showing no excessive wear. This shows that you can use water-glycol even where lubricity and resistance to corrosion are critically important.

The water-glycol cost 4 times more than oil, but we made up the difference in uninterrupted production, lower maintenance costs, no fluid changes and—of course—fire protection. ▼▼▼



DIECASTER'S OPEN FLAME and pot of molten metal make it a natural place to use fire-resistant hydraulic fluids.

CIRCLE 109 ⟶



Curved inlet ❶ directs incoming air in downward helical pattern. Larger impurities and condensate are "thrown out" by centrifugal action, collecting on bowl sides and spiraling downward past baffle ❷ into quiet chamber for draining off. Baffle traps sediment in quiet chamber ❸ and allows only dry air centrifugally cleaned of larger impurities to reach porous bronze filter element ❹ where finer particles are filtered out.

Diaphragm of large area ❺ is of BUNA-N—imparts extra sensitivity for response to even minute reduced pressure variations. Aspirator ❻ acts directly on diaphragm, providing instant compensation for fluctuating loads . . . assures precise control and stabilizes pressures reaching individual pieces of equipment.

High velocity venturi section ❼ provides ultra-fine, enduring atomization at air flow rates even less than 1 CFM. An exclusive by-pass feature ❽ provides lubrication at high flow rate without excessive pressure drop—wide range performance in **one unit.** Proof of lubricating efficiency assured because **all** visible metered oil is atomized.

NOW! Get this efficient TRIPLE LIFE-GUARD protection for your pneumatic equipment

A continuous supply of clean dry air . . . at a constant pressure . . . with just the right amount of lubrication provided at points of friction and wear. Air-operated equipment requires this three-way protection today; the Watts combination of pneumatic controls *assures* it.

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Oil additives keep systems clean

You can't make a dollar out of fifteen cents by putting additives into a cheap base oil. But a premium base with proper additives gives a superior hydraulic fluid.

IN ADDITION to lubricating moving parts in valves and cylinders, and maintaining viscosity through temperature changes, a good hydraulic fluid must:

1. Resist oxidation and chemical deterioration.
2. Prevent rusting of internal surfaces.
3. Prevent foaming and permit quick release of entrained air.
4. Permit water to separate out quickly.

The first three of these are usually accomplished by the use of additives or inhibitors which keep the fluid and system working well.

• **To Prevent Oxidation**—Oxidation is the biggest factor in oil life. It is the reaction of oxygen with the oil to form various compounds. The soluble compounds which are formed increase oil viscosity and corrode certain metals. The insoluble compounds make the system sluggish or inoperative by reducing clearances and plugging valves and lines.

The normal operating conditions in a hydraulic system: elevated temperature, high pressure, contaminants, water, metal surfaces, and agitation all increase oxidation. Anti-oxidation additives decrease or stop the effect of these on oxidation. These additives may be either of two types: (1) chain breaker type that interrupts the oxidation reaction soon after it starts; (2) metal deactivator type which reduces the catalytic effect of the metals.

• **To Prevent Rust**—Moisture gets into a hydraulic system through condensation of air which enters through leaks on the intake side of the pump, vents in the reservoir, and contamination. Trying to eliminate all moisture from the system is both expensive and unreliable.

A rust preventing additive in the fluid works by keeping moisture away from metal surfaces. Although the action of a rust inhibitor is not completely understood, the best explanation is that it plates out on the metal surfaces forming a film which moisture cannot penetrate. Although the amount of rust inhibitor is less than 1% of the total oil, this protects all metal surfaces against rust. The thickness of the protective film is difficult to measure, but it has been estimated at several molecules.

• **To Prevent Foam**—Hydraulic oils usually contain about 10% air in solution, and will absorb much more under pressure. This air in solution is harmless, but if air is dissolved when the oil is under pressure, it will come out of solution when pressure is released producing foam. If this separated air is trapped in a cylinder, it will cause erratic action because of its high compressibility compared to oil.

Another result is that when the air is compressed, it becomes very hot. For example, if air is quick-

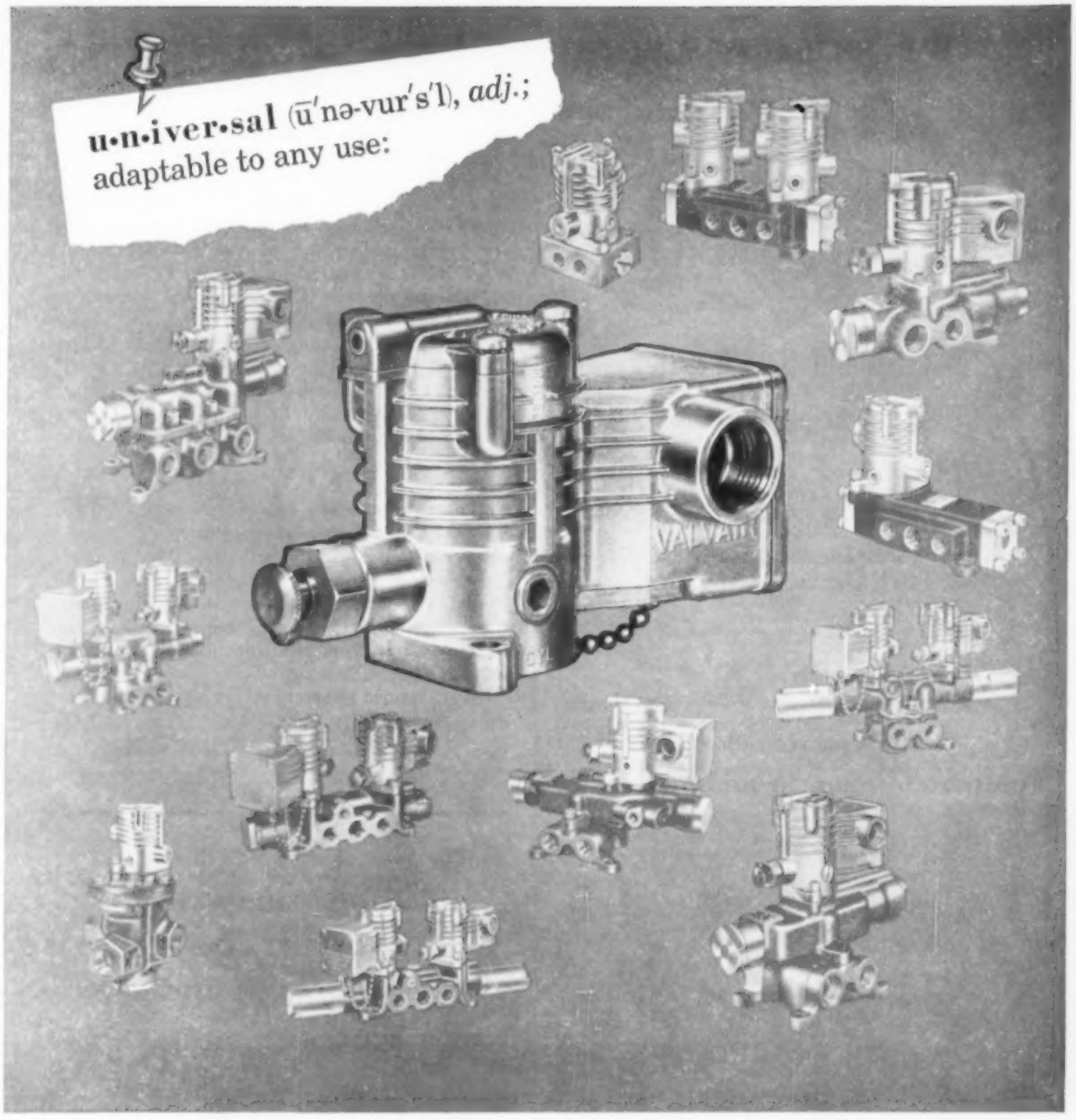
Concluded on page 85

TABLE I
Effect of Inhibitors in Various Base Oils (Visc of base oils: 300 SSU at 100° F.)

	Hrs. required for 2.0 Neutralization Number in ASTM oxidation test	
TYPE BASE OIL	WITHOUT ADDITIVES	WITH ADDITIVES
Red Engine Oil	Approx. 75	169
Pale Machine Oil	Approx. 75	405
Turbine Grade Oil	Approx. 75	1625

TABLE II
Comparative Operation Of Straight Mineral Oils And Premium Grade Oil

	Turbine Grade Mineral Oil	Premium Grade Oil Inhibited
EQUIPMENT	DRAIN PERIOD	DRAIN PERIOD
TEN MILLING MACHINES	FREQUENT	TRIPLED LIFE
MACHINE TOOL	500-700 HRS	2400 HRS.
RIVETER	30 DAYS	60 DAYS
BROACHING MACHINE	14 DAYS	90 DAYS
GRINDER	3 MONTHS	2 YEARS



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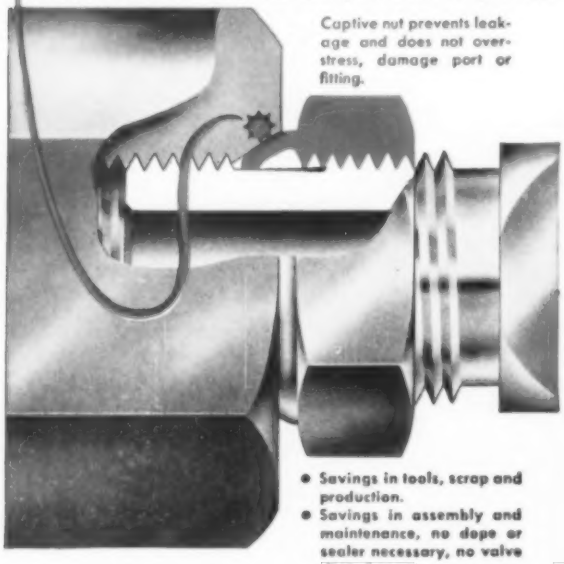

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OIL ADDITIVES

ly compressed to 100 psi, its theoretical temperature rises to 485 F, and at 3000 psi it is 2020 F. Of course when the air bubbles are surrounded by oil, the temperature is lower, depending on the rate of compression, absorption of air into the oil, and heat lost by conduction. However the temperature is still high enough to scorch the surrounding oil and produce oxidation. This heat will probably not be noticed in the temperature of the oil, but the continuous oxidation will eventually ruin all the oil.

The degree of foaming depends on the viscosity of the oil, source of the crude, the way it was refined, and how it's used in the machine. Foaming can be made negligible by additives which cause it to break up quickly and separate out any air entrained in the oil.

• **Water Separation**—Moisture entering a hydraulic system through contamination or condensation, emulsifies with the agitating oil. Any soluble oxidation products in the oil increase this process. This emulsion may be thin and slurry-like, thick and pasty, or heavy and gummy. It increases collection of grit and dirt, and also increases friction wear and oxidation.

Highly refined mineral oils permit water to separate out quickly. ▼▼▼

Information for this article was supplied by The Texas Co.

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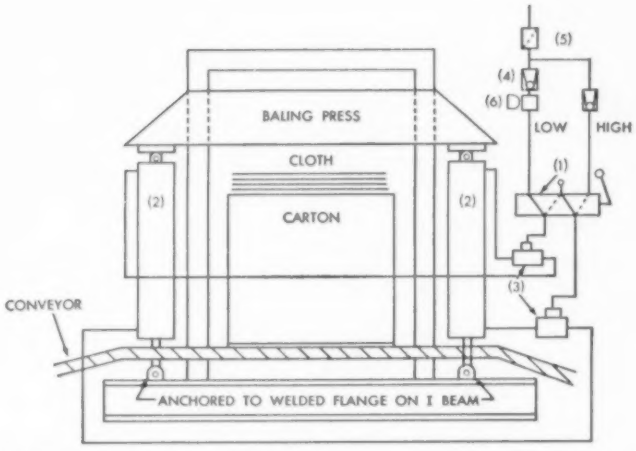
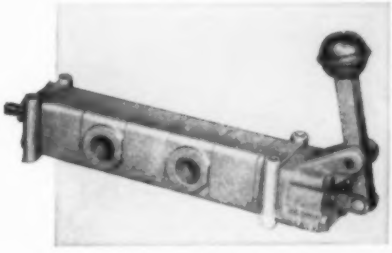
CIRCLE 32 ON TIME-SAVER CARD

Westinghouse air circuitry cuts packaging labor costs 28%



Devices: (1) PD4-42-0001 PILOTAIR® Valve (2) "A" Cylinder (3) Quick Release Valve (4) Reducing Valve (5) Filter (6) Lubricator



"D" PILOTAIR® VALVE

The Westinghouse PD4-42-0001 PILOTAIR® Valve is the key to this entire pneumatic control system. "D" PILOTAIR® Valves are two-, three-, or four-way directional valves, with lever, cam, solenoid, pneumatic, pedal, and treadle operation. They have two and three positions, with port sizes of ¼" and ½" ips. They provide a choice of over 30,000 valve operator positions. Maximum operating pressure: 250 psi.

The diagram shows a baling press at the Arista Mills Company in Winston-Salem, North Carolina, makers of blue chambray cloth. The press was recently converted from heavy gear operation to pneumatic control. The pneumatic control system was designed by the Livingston & Haven Company, of Charleston, South Carolina. Westinghouse Air Circuitry has enabled Arista Mills to put 28% more cloth in each carton. Since labor costs per package are about the same as with their previous method, they are realizing an approximate 28% saving in labor costs. The heavier, more fully packed cartons also have cut handling costs, cut carton costs, and made available more critical warehouse space.

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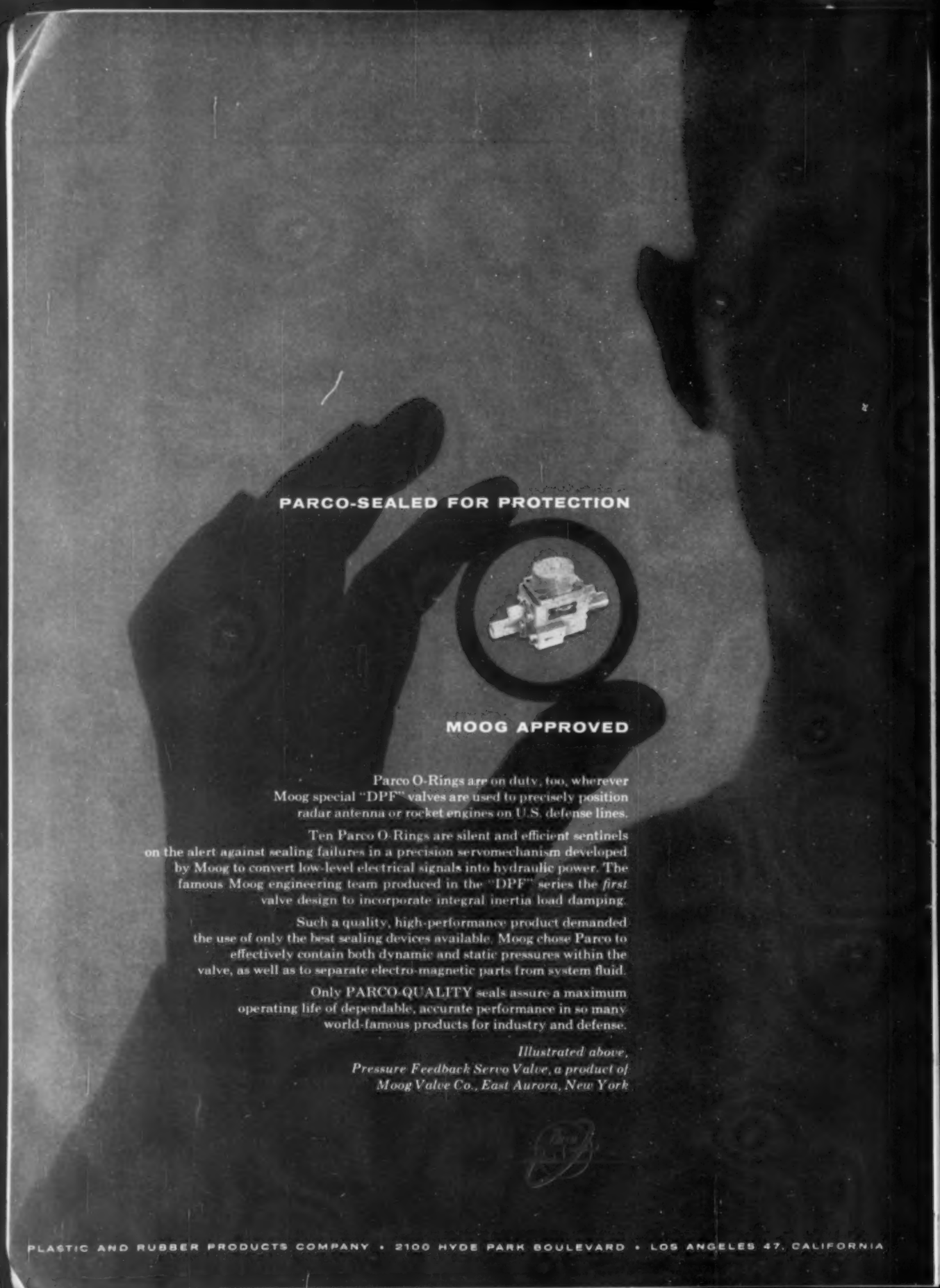

Parco O-Rings are on duty, too, wherever Moog special "DPF" valves are used to precisely position radar antenna or rocket engines on U.S. defense lines.

Ten Parco O-Rings are silent and efficient sentinels on the alert against sealing failures in a precision servomechanism developed by Moog to convert low-level electrical signals into hydraulic power. The famous Moog engineering team produced in the "DPF" series the *first* valve design to incorporate integral inertia load damping.

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Illustrated above,
Pressure Feedback Servo Valve, a product of
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AVIATION SECTION

CHARACTERISTICS OF DEPTH AND EDGE-TYPE FILTERS 90
By Herbert H. Howard

Keeping hydraulic systems clean is certainly important. But what's the best type of filter to use for the job? Here are some answers on when to use depth or edge-type filters. Size, weight, efficiency, etc. are compared.

SAE MEETING HIGHLIGHTS—NEW FLUID POWER SYSTEMS 96

Higher operating temperatures for both hydraulic and pneumatic systems have prompted much research and development of new systems, components, and fluids. Many interesting reports on progress were given at the Spring SAE A-6 Committee meeting.

AVIATION NEWS FROM THE FLUID POWER FIELD 100

AVIATION COMPONENT DATA 102

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CIRCLE 77

Characteristics of depth and edge type filters for hydraulic systems

• By HERBERT H. HOWARD, *Chief Engineer*
Permanent Filter Corp., Los Angeles, California

Aircraft hydraulic systems often have either a depth type filter such as bonded metal, or an edge type such as wire mesh. Here's how these work and what they'll do.

DEMANDS for more precise and reliable hydraulic system performance in aircraft and missiles makes the use of the right number of the right kind of filters a must. High performance means small clearances. Reliability demands that dirt and other contaminants be removed so these clearances will not be enlarged by abrasion or moving parts jammed by particles in the small clearance spaces, Figure 1.

• **Filter Types**—There are four basic types of filters. Each uses a different type of filter medium. These filters are:

1. Depth Type—Dirt is removed as the fluid flows through, long winding, narrow passages. Bonded metal filters are of this type. Sand and porous ceramics are also used as media in depth-type filters.
2. Edge Type—Here the surface presented to the fluid is nearly flat. Fluid flow passages are short but the fluid must flow through openings of a fixed size. A typical filter medium for an edge type filter is wire mesh or screen. The mesh may be made of stainless steel, monel, or other corrosion resistant alloy to fit the application.
3. Absorbent Type—These "soak" the fluid through the filter medium. Felt, cotton, paper, waste, asbestos fiber are some of the media used.
4. Adsorbent Type—Dirt is collected on the surface of particles of the filter medium. Fuller's earth, charcoal, silica-gel, activated alumina, and bauxite are typical adsorbent media.

In general, pressure drop through the depth and edge types is lower than through the other two types. Adsorbent filters are

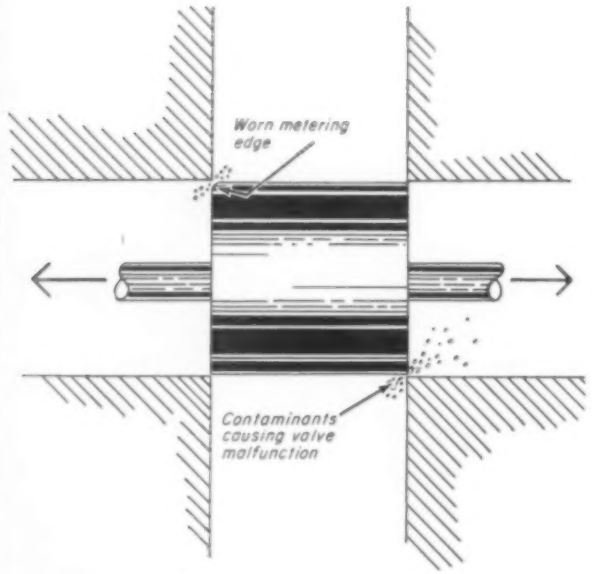


FIGURE 1. SKETCH of a spool-type valve shows how dirt may wear the valve lands and cause the spool to jam. This construction is typical of the servo valves used in aircraft and missiles.

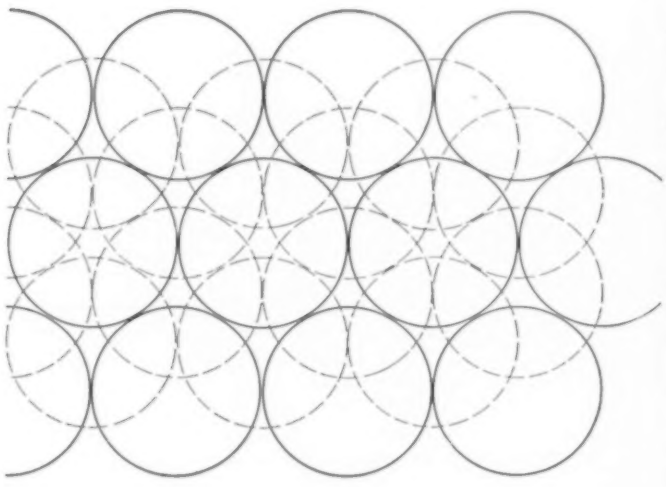


FIGURE 2. LAYERS of tiny balls bonded together make long, winding passages through which the fluid being filtered must flow.

not recommended for filtering inhibited hydraulic fluids because they will remove the additives commonly used.

• **Depth Type Metal Filters**—Millions of tiny metal spheres are bonded together in an inert gas atmosphere, a vacuum, or a controlled atmosphere, to make the filtering element. The spheres are uniform and are regularly spaced. The firm bond attained makes it impossible for any of the spheres to come loose and be carried into the hydraulic system regardless of pressure surges, vibration, and high temperatures.

Passages between the spheres and layers of spheres, Figure 2, are long and winding. Even though dirt particles may pass through the first layer, chances of their getting through all the succeeding layers are infinitely small. This type of construction is good for removing hair-like particles which may be much longer than the filter rating size although their diameter is smaller.

A high percentage of particles smaller than the filter rating is also removed by this type of filter. This is felt to be a plus value because it is suspected that a large number of extremely small particles may account for erosion damage. Depth-type filters will also remove or separate liquids which are not soluble in the hydraulic fluid and have different specific gravities than the fluid. For example, they will remove 99.9% of the water from hydraulic oil.

An additional point worth mentioning is that the accumulation of filtered particles on the surface and in the passages of the filter element results in even finer filtration than when the element is new and clean.

• **Edge Type Metal Filters**—Often, these filters are made of metal wire—as many as 325 by 2400 strands per inch may be used. The wire is, in most cases, stainless steel. Since this type of filter has only one filtering layer, any particle smaller than the mesh opening will pass through. The opening is, however, reduced as the filter is used because of an accumulation of filtered particles on the upstream side.

Flow through these filters is high for their size and weight. This is because they offer little resistance to flow. Therefore, pressure drop through the filter

TABLE I

Properties of Edge and Depth Type Metal Filters

CHARACTERISTIC	EDGE TYPE (STAINLESS STEEL)	DEPTH TYPE (BONDED METAL)
Size, comparative	Same	Same
Weight comparison	Less	More
Flow rate, initial	Higher	Lower
Holding capacity	Lower	Higher
Price	Higher	Lower
Strength	Same	Same
Pressure drop, initial	Lower	Higher
Maximum pressure, psi	10,000	10,000
Operating temperature range, deg F	—320 to 1200	—320 to 550
Permissible G load (aircraft)	15	15
Permissible G load (missiles)	50	50
Vibration range, cps	2 to 2000	2 to 2000
Suitable for corrosive liquids	Yes	Not below 10 microns
Ability to remove flakes, long particles, and particles smaller than rating.		Better

FIGURE 3. FILTER ELEMENTS are made in a variety of types and sizes to fit many space requirements.

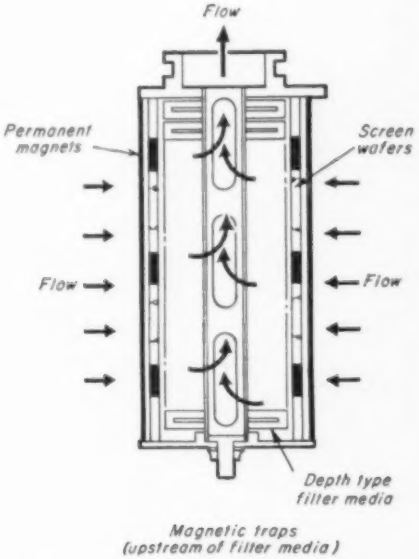
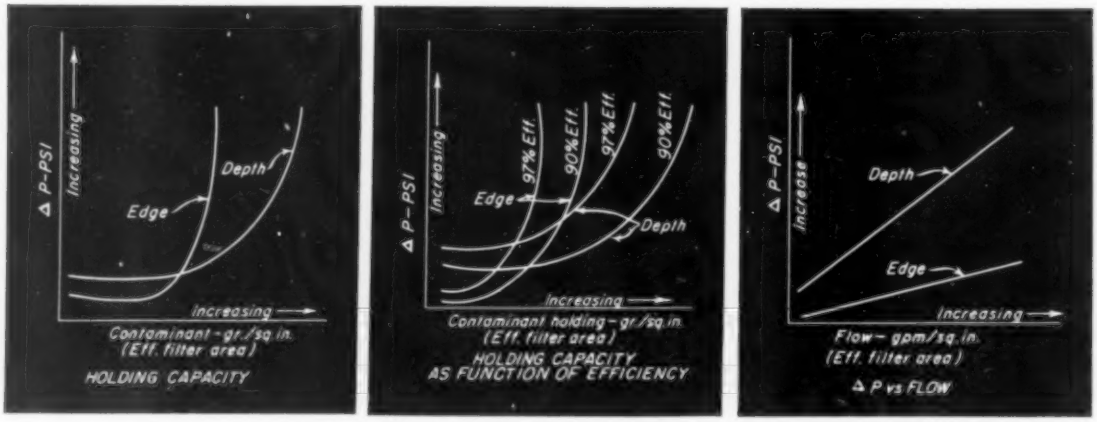


FIGURE 4. PERMANENT magnets built into a filter housing, remove iron particles and improve filtering.

valves used in aircraft and missiles.



PERFORMANCE CURVES for depth-type and edge-type filters.

is low. Resistance to shock, pressure surges, vibration and temperature extremes is excellent.

Effective filtering surface of edge type filters as well as mechanical rigidity can be increased by accordion-pleating the wire cloth. Mesh size is very carefully controlled for uniformity in wire cloth intended for filtering. Ends of the filter element are bonded to end caps by swaging, brazing, or spot-welding. Thus, there is no danger of any bonding agent contaminating the system as might happen if solders or adhesives were used.

• **Comparisons**—Edge type filters cost more than depth type metal filters. They are, however, more compact, lighter, and have lower initial pressure drop than depth types. Bonded metal filters, however, have a higher dirt holding capacity. Table I and the performance curves summarize and compare important properties and characteristics of these two types of filters.

• **Physical Characteristics**—Filter assemblies are available in a number of sizes and shapes to fit in long, thin or short, fat spaces, Figure 3. Whenever possible, selection should be made from standard units, like these. Mounting and connection arrangements also vary.

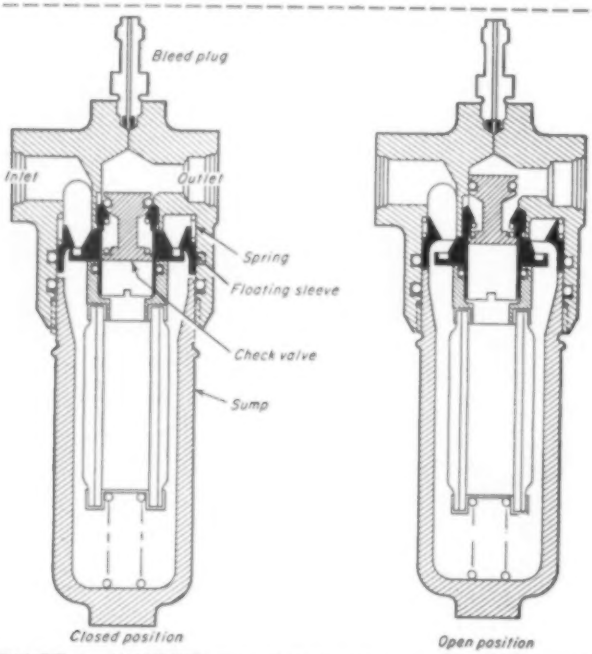


FIGURE 5. BLEEDER and shutoff valves can be an integral part of a filter assembly.

• **Filter Accessories**—Filtration efficiency of any type of filter can be improved by using magnets to trap iron particles. Both edge and depth type metal filters can be obtained with permanent magnet elements as part of the filter assembly, Figure 4.

Since air in hydraulic systems, particularly servo systems, is bad for performance and fluid life, air must be bled-off. Filters are made with bleeder plugs to simplify bleeding after a cartridge change. Automatic shutoff valves in filter housings let cartridges be changed without air entering the system or fluid escaping, Figure 5. These automatic shutoff valves will maintain back pressure of about 150 psi on the system during a cartridge change.

• **Filter Location and Number**—Allowable weight, fluid flow rates, and degree of filtration needed all affect how many filters to put where. In general, any component needing filtration finer than 20 microns should have its own filter, immediately upstream.

The best way to show how these factors affect number and location of filters is with some examples. In the system shown in Figure 6, one main and two auxiliary filters are used. The filter upstream of the servo valve gives fine filtration for the valve. The main filter, downstream of the accumulator, provides coarser overall filtration. The other filter, downstream from the main filter,

provides-additional filtration of the main filter output and gives protection in case of failure of the main filter.

In a missile hydraulic system, Figure 7, only one filter is used because the circuit is quite simple and the amount of oil to be filtered is small.

• **Filter Circuits**—Although full-flow filtration—filtering all of the pump output—gives the most protection from dirt in the system, other methods of connecting filters are often used. These systems filter only a part of the pump output, but all the oil in the system eventually passes through the filter. Smaller filters can be used in these circuits than would be necessary for full-flow filtering.

In the shunt circuit, Figure 8a, part of the pump output passes through the filter to the working circuit. The rest of the oil goes directly through a pipe or tube. To make this circuit work, some restriction is required in the line in parallel with the filter. Total restriction of the two parallel paths is still less than that of a full-flow filter.

Part of the pump output is filtered and returned straight to the tank in the circuit shown in Figure 8b. Here a restricting orifice or flow control valve is used in the filter line to limit the amount of pump output bled-off through the filter.

Where no restriction of pump output can be allowed, and full pump output must be supplied to the working circuit, schemes shown in Figure 8c and 8d can be used. In the return line filter circuit shown in Figure 8c, oil is filtered as it returns to tank. The spring-loaded check in parallel with the filter limits back pressure due to either high flow rates or filter clogging.

Only the oil bypassed by the relief valve goes through the filter in the circuit shown in Figure 8d. A spring-loaded check is used here to limit back pressure on the relief valve. For adequate filtration with this circuit, relief valve setting must be exceeded during a fairly large part of the circuit operating time.

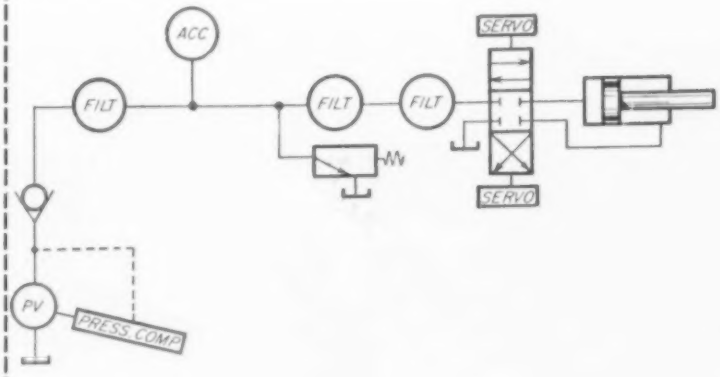


FIGURE 6. MORE EFFICIENT filtration is given in this circuit by using three filters. Coarse filters upstream simplify the job of the downstream filter.

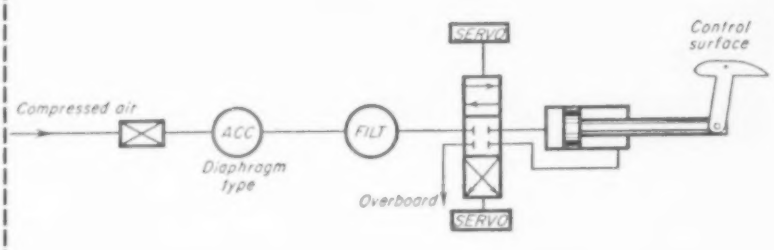


FIGURE 7. IN THIS SIMPLE missile hydraulic system, one filter just ahead of the servo valve best fills the requirements of fine filtration, low weight and little space.

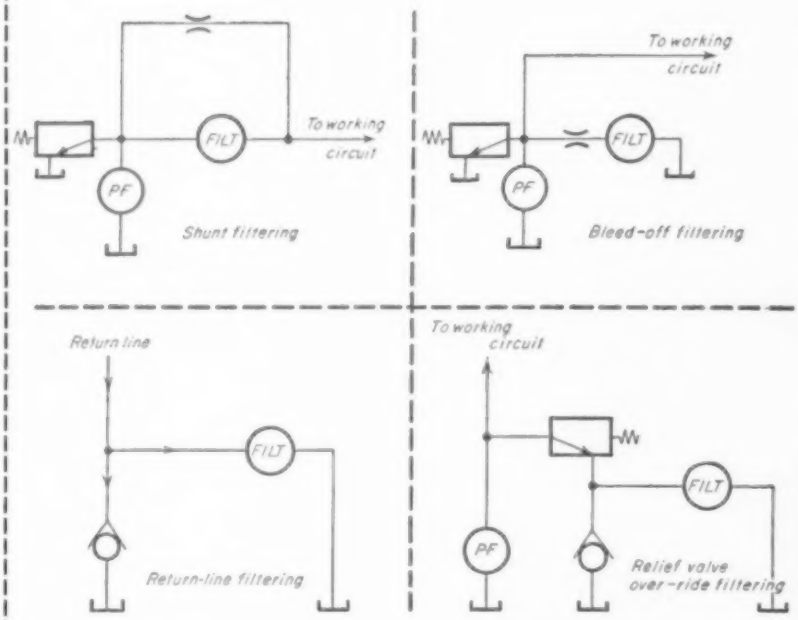


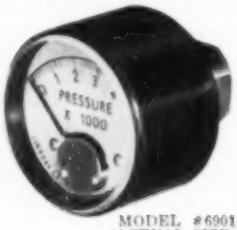
FIGURE 8. CIRCUITS other than full flow can be used. Filters may be smaller since flow rates through them are not as high as the full-flow circuit. Protection is not as good as full-flow filtering.

New high pressure gauge passes 25 G "torture test" with ease

This photograph shows vibration testing of RMC-Lindsay gauges on the 3200 force pounds Calidyne Vibrator—1 to 25 G output, amplitude .0001 to .20, cycling frequencies to 2,000 cps. Pressurizing and testing are uniquely accomplished so as to parallel actual installation conditions. Complete test reports are available on request.

RMC-LINDSAY GAUGE

already checked out in Atlas missile and B-52



MODEL #6901
(ACTUAL SIZE)

The Atlas ICBM and B-52 bomber are two of the newer space age vehicles to use the RMC-Lindsay high pressure gauge. In both laboratory test and actual use, this gauge has met all requirements with room to spare.

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LINDSAY PRESSURE GAUGES

CHARACTERISTICS OF DEPTH AND EDGE TYPE FILTERS

Continued

• **Packaged Filters**—More and more airborne hydraulic systems are being packaged. That is, pumps, accumulators, reservoirs, valves, filters, and piping connections are all being built as a single unit. Filter selection for these applications is no different than for unit filters. Various types and sizes are available for built-in use. Space restrictions may make it difficult to provide a filter immediately upstream of critical components with packaged construction. However, it should be done if at all possible.

• **Filter Ratings**—In addition to flow rate, allowable pressure drop and working pressure, dirt holding capacity and degree of filtration are the important filter ratings. All except filtration efficiency are well defined and easily understood.

Usually, a filter rating of 5 microns, or any other value, is assumed to mean that the filter will remove 98% of the particles of that size or larger. Absolute rating is the particle size which will be 100% removed by a clean filter. Absolute rating for a nominal 5 micron filter might be 10 microns or it might let even larger particles pass. The only way to be really certain of what you're getting in a filter is to discuss it with the manufacturer.

Even then, there is a possibility of confusion because of differences and a lack of correlation between widely used filter testing methods.

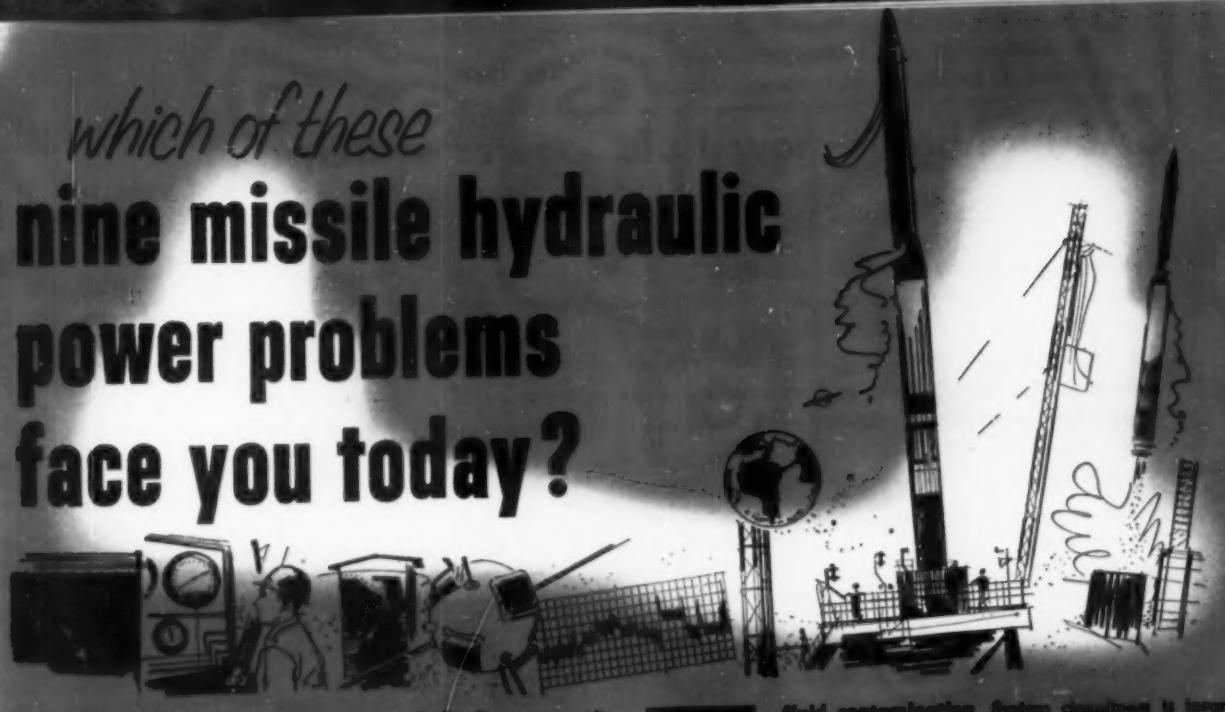
For example, one widely used test method uses glass beads as a controlled contaminant. Because the beads are spherical or nearly so, this test is not a fair measure of filter performance when long, thin particles may contaminate the hydraulic fluid. There are also other methods for testing filter performance. Since they are not universally accepted, there seems to be little point in discussing them here. Universal adaptation of one realistic method of evaluation seems to be the only solution to this dilemma. ▼▼▼

CIRCLE 84 ON TIME-SAVER CARD

CIRCLE 37

which of these

nine missile hydraulic power problems face you today?



PROBLEM

weight and space Eastern hydraulic power units are made of *miniature* high-speed gear pumps, close-coupled directly to performance-tested electric motors. Even when components are added such as reservoir, expansion-relief valve, expansion bellows, adjustable pressure-regulating valve, check valves -- total weight is under 5 pounds, size only 7¾" x 2⅝" x 7⅝" (Eastern unit illustrated used as example).

PROBLEM

high temperatures Most Eastern units normally operate at temperature range of −67°F. to +290°F. Higher temperature limits are no problem.

PROBLEM

reliability The necessity for high performance and reliability in executing commands of the guidance system, makes hydraulic systems a vital link in performance. Eastern systems have gained the reputation for outstanding reliability under extreme environmental conditions when operating at high speeds.

PROBLEM

high-speed power take-off Eastern gear pumps with speeds of 24,000 RPM permit direct drive by main power source.

PROBLEM

complicated, heavy plumbing Running lines from power unit to remote areas can be eliminated by using individual self-contained hydraulic power units at each point. You gain maximum flexibility, simplicity, reliability, while removing more weight in plumbing than you add in power packs.

PROBLEM

compromised accessory performance When all accessories adapt the 3000 PSI main system pressure by means of power-wasting, heat-producing, pressure-reducing valves, performance suffers. Eastern units offer individually selected hydraulic fluids and pressures to give optimum performance to each accessory in the system. Eastern units have capacity to 1.5 GPM at pressures to 3000 PSI.

Eastern Aviation Bulletin 300 provides a wealth of performance data. Request your personal copy today.

PROBLEM

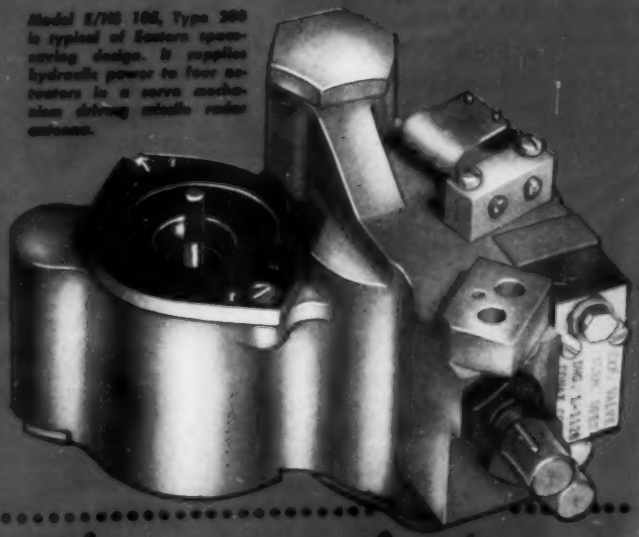
field contamination System cleanliness is insured by a sealed system and continuous filtering of pump discharge.

PROBLEM

runaway costs Eastern uses standard mass-produced components, arranges them to match your space, to give you a custom design with minimum development expense.

PROBLEM

divided responsibility Eastern welcomes the opportunity to develop components or complete missile subsystems in hydraulic power, electronic cooling and refrigeration, and pressurization. Design and manufacturing responsibility from one experienced source is your assurance of dependable performance. Write, phone, wire for complete information.



Model E/HS 166, Type 300 is typical of Eastern space-saving design. It supplies hydraulic power to four actuators in a servo mechanism driving missile radar antenna.

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SAE highlights—new fluid power systems

Spring meeting of the SAE committees on the development of standards for aircraft and missile hydraulic and pneumatic systems and equipment was held May 6-9 in Ft. Worth, Tex. Here are abstracts of several very interesting reports on work being done to make the hydraulic and pneumatic systems of today's and tomorrow's aircraft and missiles work and work reliably.

1000 F PNEUMATIC SYSTEM

Charles H. Cannon, Lockheed-Marietta—who was appointed Chairman of Subcommittee A6-B, Pneumatics—told of their development work on a 1000 F, 5000-psi pneumatic system. They got the contract for development of this system in May, 1957.

• **Materials**—Since lubrication at 1000 F by usual methods is impossible, a big part of their work has been to find materials to work at this temperature with little or none. Electrolized and flame-plated surfaces seem to be best, so far. Haynes Alloy No. 25 also resists wear well. Dry film lubricants which are fair for this service are Electrofilm 2006, Everlube and Metal Matrix. The latter two are more apt to scale than the first.

• **Fittings**—Both MS and AN fittings of Inconel-X on Inconel-X tubing were tested and found successful. To prevent galling threads were silver plated, electrolized, or coated with a dry film lubricant. Fittings were easily removed after the test. Fitting sleeves, also of Inconel-X, were electrolized to increase hardness and the depth of bite in the tubing.

• **Static Seals**—Four types of static seals were tested to 1000 F with pressure cycled from 0 to 5000 psi. All are satisfactory since leakage was less than 80 cc per minute after test. Two types, the WADC boss seal of Inconel and the Autonetics seal, are thought best because several test samples didn't leak at all. Other seals tested were Skinner Spring seals and Fulton-Sylphon V-Face seals.

• **Actuator**—One cylinder has so far been tested. The 4-in. bore, 10.8-in. stroke cylinder has a rod diameter of 2 in. The Inconel-X barrel has a pressed-in Haynes Alloy No. 6B liner. ID of the liner was machined to a 2 rms finish. Koppers carbon seals on the piston and rod gland have been tried. Breakout friction with these seals is only 8 pounds. There is however some leakage past the end seal. More work is going to have to be done here to evaluate other designs.

• **Servo Valves**—So far, spool-type valves are best. However, they leak too much. Most promising competitor is a rotary spool valve. A cylindrical spool with a length to diameter ratio of 1:1 rotates in a sleeve. Metering is through orifices on the periphery of the sleeve. The fit of this spool in the sleeve can be very close with no binding problem. It takes much less force to work this valve than a sliding spool for the same fit.

Poppet-type valves are also being worked on. Though this type of valve does not seem to be a good servo valve by nature, it is almost leakproof. Therefore, design studies are continuing.

HIGH-TEMPERATURE HYDRAULIC SYSTEM

Development of a 1000 F hydraulic system has been going on for about as long as the 1000 F pneumatic system. William E. Mayhew of Republic Aviation Corp. reported on progress. In this system, servo valve and actuator are exposed to 1000 F fluid and 1200 F ambient temperature. Pump inlet fluid temperature is 700 F with an ambient temperature of 600 F.

Material problems in this system are similar to those of the high-temperature pneumatic system. Mr. Mayhew reported that their experience has been substantially the same as that of Mr. Cannon and Lockheed-Marietta. The most important problem at the moment is the fluid.

• **Fluids**—There are four classes of organic fluid that show some promise. These are: polyaromatics, polyaromatic ethers, silphenylenes, and arylsilanes. Initial decomposition temperatures of the most promising fluids in each class are above 800 F. Tests on a polyaromatic ether with estimated decomposition half-life of 7000 minutes at 900 F, were run for periods of ½ to 7½ hours at temperatures from 300 to 980 degrees. Fluid used in the tests has a freezing point of 230 F but tests were nevertheless run because of assurance that the freezing point could be lowered without hurting the other properties of the fluid.

Test results showed that the decomposition products are either gaseous or soluble. Therefore, the filter didn't clog and the pump kept running. If the fluid cannot be improved, system design may make its use possible. Deaerators, extra fluid volume in the reservoir, or flushing and refilling after each or several flights may be necessary.

• **Organic Fluid vs. Liquid Metal**—Since much work has been done with a eutectic alloy of sodium and potassium (NaK_{77}) as a possible hydraulic fluid, some comparisons may be made between this mixture and the polyaromatic ether. NaK_{77} shows better thermal stability, vapor pressure, bulk modulus, and nuclear radiation resistance. The organic fluid has better oxidation stability, lubricity, viscosity, non-

CIRCLE 67

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Turbine shafts in ballistic missiles must turn smoothly at terrific speeds . . . stand up under intense heat. That's why critical points of wear on these shafts for Atlas, Thor, and Jupiter missiles are Flame-Plated by LINDE's unique process. Engine systems for all three missiles are built by Rocketdyne, a division of North American Aviation, Inc.

Flame-Plating is LINDE's special process by which a hard, thin coating of tungsten carbide, aluminum oxide, or other materials is applied to a metal surface. Flame-Plated coatings have outstanding resistance to wear, abrasion, and fretting corrosion, even at extreme temperatures. They consistently outlast hard chrome plating, tool steels, and in some cases even solid tungsten carbide. Flame-Plated coatings can be used as coated (125 micro-inches rms), or ground and lapped to better than one micro-inch rms finish.

If you have a wear problem that could be solved by a harder, longer-wearing surface—call your nearest LINDE office and find out what Flame-Plating can do for you. Or write Flame-Plating Department, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.

Principal wear surfaces of missile turbine shafts Flame-Plated by LINDE with tungsten carbide are indicated by arrows.

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flammability, and corrosion resistance characteristics.

From the system design standpoint, NaK_{77} will require an absolutely leakproof reservoir because it burns at room temperature and is very corrosive. Reservoir for the organic fluid must be absolutely air tight to prevent rapid oxidation and must be highly pressurized because of the low boiling point (850 F).

It is much easier to design a pump for the organic fluid. Chemical activity and low lubricity of NaK_{77} would surely result in a pump of low efficiency and short life that would generate a lot of heat.

Filtration of the NaK_{77} fluid to prevent jamming the servo valve is critical. Since the oxides formed may be soluble in the remainder of the fluid at certain temperatures, cold traps would have to be used to be certain that the dissolved oxides precipitate out at the proper places. Temperature differentials will have to be carefully controlled to do this.

Ground handling procedures with NaK_{77} would call for an entirely new approach. This mixture will explode violently when it contacts water. Special protective clothing and special fire fighting equipment would be necessary. Ground handling equipment would be complex and costly. The polyaromatic ether, on the other hand, is handled about like any of the presently used fluids.

In view of all this, the use of NaK_{77} as a hydraulic fluid does not appear to be warranted. However, its high bulk modulus and boiling point may eventually be sufficient to overcome its drawbacks, particularly if these can somehow be improved by additives.

BOEING EXPERIENCE IN HIGH-TEMPERATURE HYDRAULICS

E. T. Raymond, research engineer, Boeing Airplane Co. reported on his company's experience with high-temperature hydraulic systems and components. Maximum temperature for their work was 700 F. Most of it was done at temperatures of 400 to 550 F.

• **Pumps and Fluids**—Two standard New York Air Brake pumps successfully passed the 560-hr endurance test per MIL-P-7740B at room temperature with Versilube F-50 (GE-81406) and GE-81644 fluids. In addition, GE-81644 was used in a pump break-in run at pressures to 4000 psi and temperatures to 600 F. Total operating time was 24 hours. Approximately 5 hours were at 600 F. Testing stopped then because of personnel irritation problems. The pump when disassembled appeared satisfactory except for a coating of tin plate on all bronze bearing surfaces.

• **Flight Control System**—A power flight control system mockup is now being tested at ambient temperatures to 600 F. No elastomeric seals are used. Static seals are metal O-rings and Skinner bellows-type metal face seals. Dynamic seals are metal and nonorganic seals of special design. The dynamic seals are special Boeing designs under development.

The 7.5 gpm, 4000 psi system uses Versilube F-50. Reservoir is airless and is pressurized by a gas acting on a metal bellows to provide makeup and pump suction pressure. Fluid is cooled before entering the pump and heated before entering the control servo. The servo is a Boeing design using mechanical input and position feedback.

This mockup has been tested at ambient temperatures from 70 to 600 F through the full pressure range. Accumulated operating time to date is 30 hours, 4 hours of this at 400 to 600 F. Purpose of this program is to determine the effects on servo valve operation of Bernoulli forces, seal friction, drive linkage stiffness, backlash, and fluid characteristics such as: viscosity, bulk modulus, lubricity, and aeration. Vendor developed components—pumps, filters, relief valves, actuators, seals, etc.—will also be evaluated.

• **Fittings, Tube and Hose**—Both MS and AN fittings are used in the servo setup, with MS predominating. No cadmium-plated fittings or components are used. Universal boss fittings are not used. Instead, standard and inverted MS bosses are made integral with the components. Fitting problems have been negligible. Tubing is standard aircraft type 304 stainless steel per specification MIL-T-6845, $\frac{1}{8}$ hard. All-metal hose, a wire braid covered bellows design, carries return flow from the valve.

• **Filters**—All-metal, 12-gpm, line-type filters are used. Filter elements are stainless steel wire cloth. Housing is AM-350 stainless. Element seal is a flat metal washer. Bowl seal is a metal O-ring. The temperature rating for these filters is 800 F.

Filter pressure drop has been found to increase with use despite various cleaning methods used. Reverse flushing, ultrasonic cleaning, and hydrochloric acid baths have been tried.

FUTURE HYDRAULIC SYSTEM REQUIREMENTS

Mr. Raymond of Boeing went on to tell of the results of a design study to determine optimum hydraulic system temperatures for advanced aircraft. Conclusion based on analysis for a supersonic bomber and a family of boost glide vehicles to operate at hypersonic speeds was that weight would be saved by cooling the system to 350 F, unless fluid for operation at 1150 F can be developed.

He recommended that effort be continued to develop fluids for long, trouble-free operation at the 350 F temperature with as good life as possible at higher temperatures to improve reliability. Ability of the system to operate at higher temperatures for short times could let a mission be completed in some instances even though the cooling system failed. ▼▼▼

PUROLATOR FILTERS
FOR THE PROTECTION OF HYDRAULIC CIRCUITS

G-200M Aircraft Restrictor Filter two-way for hydraulic oil systems metal element

PR 301 ½ GPM line type hydraulic oil filter Micronic element

PR 362 3 CFM in-line vent type Micronic element

G 200 series in-line two-way restrictor filter Metal element, internal connections

PR 312 12 GPM line type filter Micronic element

PR 412-8 12 GPM line type filter Military approval

G-187 3 GPM in-line hydraulic oil filter Metal element

P 32-26 Low pressure, high flow hydraulic oil filter

Effective filtration is essential for optimum performance in hydraulic circuits. To keep a system clean and functioning properly, it is important that the filter be designed specifically to meet the requirements of the job.

Purolator's complete line of filters for hydraulic systems includes models for every set of operating conditions likely to be encountered. A few are shown here; there are many more standard models from which to choose. If your application requires a special filter, Purolator will design and build it. Let Purolator work on your toughest filtration problem.

Filtration For Every Known Fluid

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AVIATION NEWS

from the fluid power field

Weston Hydraulics Ltd., subsidiary of Borg-Warner Corp. has appointed **Fred T. Miller** as regional sales manager. Before joining Weston he was with Peacock Engineering and Mfg., Co. and Adel Precision Products.

AIR OPERATED DOOR . . .

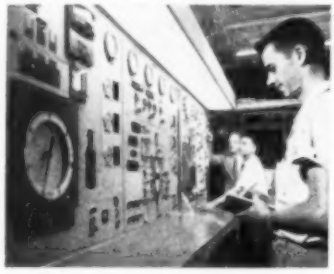
. . . weighs 3¼ tons. Double acting cylinders under 100 psi air pressure operate the 10 latches. The door is on a sonic test cell at Boeing Airplane Co., Seattle, Wash. Air latches not only make it simple to lock the heavy door but also serve as a safety device to cut off air to the sound generator when door is opened. Sound is generated by compressed air whose flow is interrupted by a motor-driven chopper valve and amplified by a horn. The generator will convert 4000 cfm of air from two 400-hp compressors into 190 decibels of sound.

Dalmo Victor Co., Division of Textron Inc., established an engineering laboratory in Monterey, Calif. Through this laboratory, the electronics firm plans to broaden its activity in the missile field and promote further development of space technology.

Greer Hydraulics, Inc., Jamaica, N. Y. has appointed **Melvin S. Schoenberg** manager of its airline sales engineering department. He has been closely associated with the design and development of the jet engine test equipment which the company now makes.

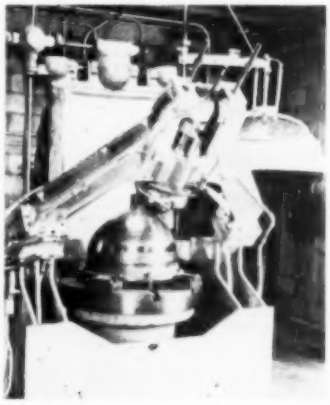
Stephen A. Bush has been named director of manufacture for **Waldorf Instrument Co., Fluid Systems Div.,** Huntington Station, L. I., N. Y. He had been director of manufacturing for the American Machine and Foundry Buffalo plant.

MAIN CONTROL PANEL . . .



. . . for the high altitude test chambers at General Dynamics Corporation's Convair Div., Fort Worth, Texas. All of the equipment supplying high-pressure, high-temperature air and vacuum to the three test chambers is controlled from this panel. The chambers will simulate conditions equivalent to 100,000 ft altitude.

HYDRAULICS SELECTED FOR SPINNING TITANIUM . . .



. . . This newly developed machine hot spins titanium alloy hemispheres for use on missiles. Preheated 6A1 4V alloy blanks are spun into spherical vessels of 16, 22 and 25 inch diameters.

Using hydraulics to power all motions allows close control of speeds, feeds and pressures. The spinning tool is on a yoke which moves up and down on an axis of the great circle of the hemisphere. With a 3000 psi system the machine can exert 12 tons of force on the small area being formed. Hydraulics powers and controls yoke motion, pressure on the spinning wheel and table speed.

The machine was developed by Titanium Fabricators Inc., Burbank, California.

Monsanto Chemical Co., St. Louis, Mo. has created an Aviation Safety Award to be given each year to the person making the "most significant and lasting contribution to aircraft operating safety."

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ONLY GREER ACCUMULATORS MEET ALL SAFETY CODES!

Qualify for any type hydraulic installation under all safety ordinances everywhere because... they're

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AIR VALVE Absolutely leak-proof for pressures up to 12,000 psi. Integrally molded one-piece valve stem prevents gas loss.

SHELL No seams. No welds. No joints. Made of single-piece homogenous chrome molybdenum steel. 18% elongation in two inches guarantees against metal fatigue. 5 to 1 safety margin above maximum working pressure of the accumulator.

MOUTH Designed to yield at 400% of maximum working pressure. This safety feature releases pressure if relief valve clogs or sticks, or if system is blocked.

PLUG ASSEMBLY Accumulator cannot be disassembled until complete gas charge in bag has been released. Lack of this safety feature has caused serious accidents. Be sure to check this protection.

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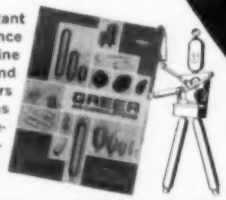
An important catalog reference on the complete line of Greer standard and special accumulators with circuit diagrams and applications. Also details on hydraulic components made by Greer such as valves, filters, actuators, etc.



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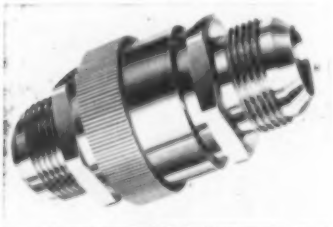
Manufacturers of Precision Test Equipment and Hydraulic Components

CIRCLE 49 ON TIME-SAVER CARD

AVIATION COMPONENT DATA

Self-sealing Couplings
. . . have visual lock indication

Series 3700 couplings are made for aircraft fuel and oil systems and low pressure hydraulic systems.



They contain opposed stem-guided poppet valves sealed by standard O-rings. A union nut with a quick-lead thread connects under pressure. A push-pull type of nut is also available. Both types have a touch and visible lock. They are made in ¼ to 2-in. sizes with all standard end styles.—*Aeroquip Corp., Jackson, Mich.*

CIRCLE 500 ON TIME-SAVER CARD

Variable Volume Pump
. . . for 3000 psi

Built for continuous operation at 3000 psi and 4000 rpm, life of the pump at this speed and pressure

is 1000 hours. Will handle fluids from —65 to 350 F. After a 560-hour endurance run at full pressure pump had 98.5 percent of its original delivery. Volumetric efficiency is 97 percent at 3000 psi and 300 F fluid temperature using MLO-8200 fluid. Delivery of the P17A1 pump is 30 gpm at 4000 rpm. Pump is a rotary-plunger type.—*Hamilton Div., Bendix Aviation Corp., Hamilton, O.*

CIRCLE 501 ON TIME-SAVER CARD

Air Bottles
. . . are made of fiber-glass

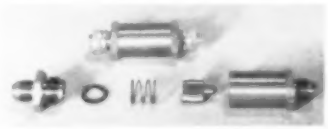
Made in sizes to 36-in. dia and for cycles to 10,000,000. Operating pressure 100 to 5000 psi. The bot-

tles weigh less than steel and will not shatter when hit with gunfire. While normally spherical they can be made in other shapes when required. Internal rubber liners minimize leakage. Air leakage from a 130 cu in. bottle is .064 lb per week.—*Apex Reinforced Plastics Division of White Sewing Machine Corp., Cleveland, O.*

CIRCLE 502 ON TIME-SAVER CARD

Restrictor Valve
. . . for 3000 psi

Restriction is caused by the creation of an annular space between the nose of the poppet and the bore, when flow is in the restricted direction. In free flow



direction nose of poppet is removed from bore providing a self-cleaning effect. It conforms to AN specification.—*The W. M. Lamagan Co., Inc., Pasadena, Calif.*

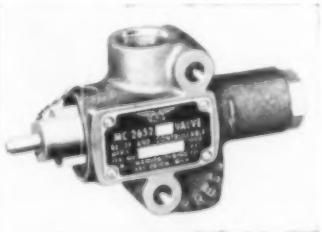
CIRCLE 503 ON TIME-SAVER CARD

Packaged Servo Drives for Weapons—is the theme of a brochure published by *Vickers Inc., Detroit, Mich.* It describes many systems made by the company over the past 20 years. The 12-page booklet has illustrations of servo drives on both airborne and land-based weapons.

CIRCLE 504 ON TIME-SAVER CARD

Controllable Relief Valve
. . . has low leakage

Intended for use in pneumatic sequencing systems, the MC 2652



valve has maximum internal leakage of 3 cc per hr with 1000 psi applied to the pressure port. The valve conforms to applicable sec-

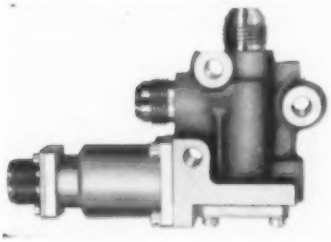
tions of MIL-P-5518A and MIL-P-8564. Ambient temperature range is —65 to 250 F. Operating pressure is 1000 psi; burst pressure is 3750 psi. Weight is 0.20 lb and ports are for $\frac{1}{4}$-in. tubing.—*M. C. Mfg. Co., Lake Orion, Mich.*

CIRCLE 505 ON TIME-SAVER CARD

Shut-off Valve

. . . for 700 F

This high-pressure valve is normally closed. A spring-loaded



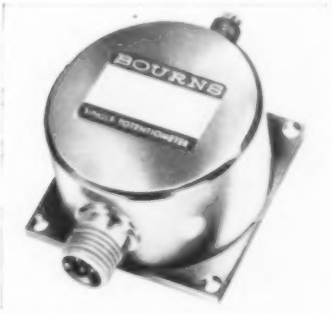
piston is controlled by a pilot solenoid valve. It can handle fluids from —150 to 350 F with ambient temperatures to 700 F. Operating pressure, 5 to 3000 psi. Size 5.03 in. long, 1.36 in. high, and 3.37 in. wide. Weight 1.75 lb.—*Aero Supply Mfg. Co., Corry, Pa.*

CIRCLE 506 ON TIME-SAVER CARD

Pressure Transducer

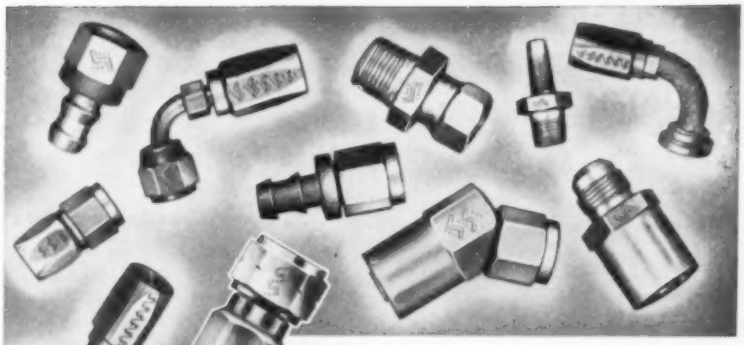
. . . has low vibration error

A new principle eliminates linkage and isolates pressure fluid from the electrical system. Designated



model 470 absolute pressure transducer, the instrument has signal error of less than .5% at 25 G up to 2000 cps and acceleration error of less than resolution at 75 G. The unit is compact measuring 1-$\frac{1}{8}$ in. on the axis. It is enclosed in welded stainless steel case.—*Bournes Laboratories Inc., Riverside, Calif.*

CIRCLE 507 ON TIME-SAVER CARD



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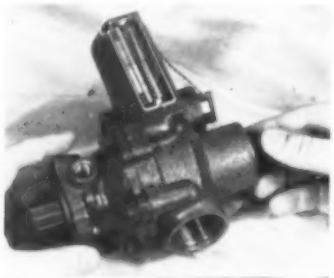
CIRCLE 95 ON TIME-SAVER CARD

AVIATION COMPONENT DATA

Gear Pump

. . . has variable volume

The main pumping elements consist of a ring gear and pinion. An integral pressure sensing de-



vice gives automatic pressure compensation, changing pump displacement to meet delivery requirements. External linkage for remote control of pump displacement can be provided. Speeds to 24,000 rpm and pressures to 3000 psi. Capacities to 80 gpm at temperatures to 500 F.—*Pesco Products Div., Borg-Warner Corp., Bedford, O.*

CIRCLE 508 ON TIME-SAVER CARD

High Temperature Test Chamber

. . . for hydraulic actuators

Cabinet was designed for testing missile hydraulic systems at temperatures to 800 F. To reduce chance of fire, nitrogen is kept in the cabinet when it is heated. Six cold water cooling elements are used to drop the temperature quickly. Chamber is made of steel and has 7 inches of insulation. Two doors at one end allow loaded trucks to enter.—*Grieve-Hendry Co., Inc., Chicago, Ill.*

CIRCLE 509 ON TIME-SAVER CARD

Pressure Switch

. . . has burst of 4000 psi

It is used to control, indicate and monitor hydraulic pressures to 3000 psi. Tests have indicated accurate repeatability over 20,000 cycles. The switch, model 65M92 can be mounted on 1.09 in. centers. It uses a piston to actuate the switch. An O-ring seals the piston from the electrical end. Pressure is factory set and the switch is equipped with a glass-sealed, single-

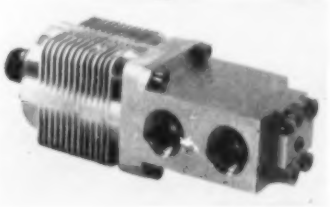
pole, double-throw electrical switch. —*Bridgeport Thermostat Div., Robertshaw-Fulton Controls Co., Milford, Conn.*

CIRCLE 510 ON TIME-SAVER CARD

Solenoid Valves

. . . for high pressures

Made for use in hydraulic or pneumatic systems with pressures



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MARSH Pressure Gauges... because they combine the most advanced features ever found in pressure, vacuum and compound gauges. There is a Marsh Gauge for every conceivable application.

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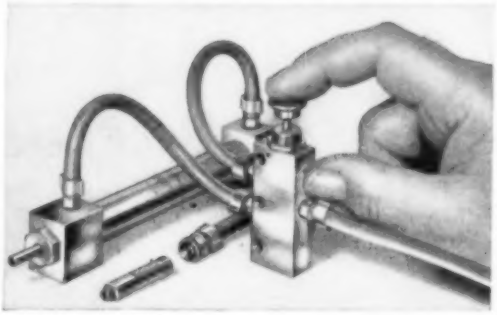
CIRCLE 68 ON TIME-SAVER CARD

NEW! MORE Powerful 9/16" MINIATURE AIR CYLINDERS · 4-WAY AIR VALVES · QUICK CONNECTS



NEW more powerful 9/16" bore spring return and double acting MINIATURE Air Cylinders to complement our widely used 3/8" bore cylinders. NEW 4-way Air Valve, Quick Connects, A.C. and D.C. Solenoids, fittings, mountings and other needed items to improve your automatic tooling and production devices or new end products. Made for MILLIONS of cycles of trouble-free operation! Modestly priced.

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CIRCLE 23 ON TIME-SAVER CARD

to 3000 psi. Over 48 models are made in 2-way, 3-way and 4-way either normally-open or normally-closed, pilot or direct operated. A quality control program conforms with MIL-Q-5923, and Air Force inspection is available.—*Skyvalve, Inc., Syracuse, N. Y. and Venice, Calif.*

CIRCLE 511 ON TIME-SAVER CARD

Pressure Switch
. . . has snap action

Unit features a trigger type snap action which eliminates welding of

the contacts. It is qualified and made in pressure settings from 5 to 4000 psi air or hydraulic. Weights vary from 0.25 to 0.4 lb. —*Hydraulic Research and Mfg. Co., Burbank, Calif.*

CIRCLE 512 ON TIME-SAVER CARD

Test Bench
. . . is completely enclosed

Made for pressures to 5000 psi and capacities to 10.5 gpm. High pressure filters are 98 percent ef-

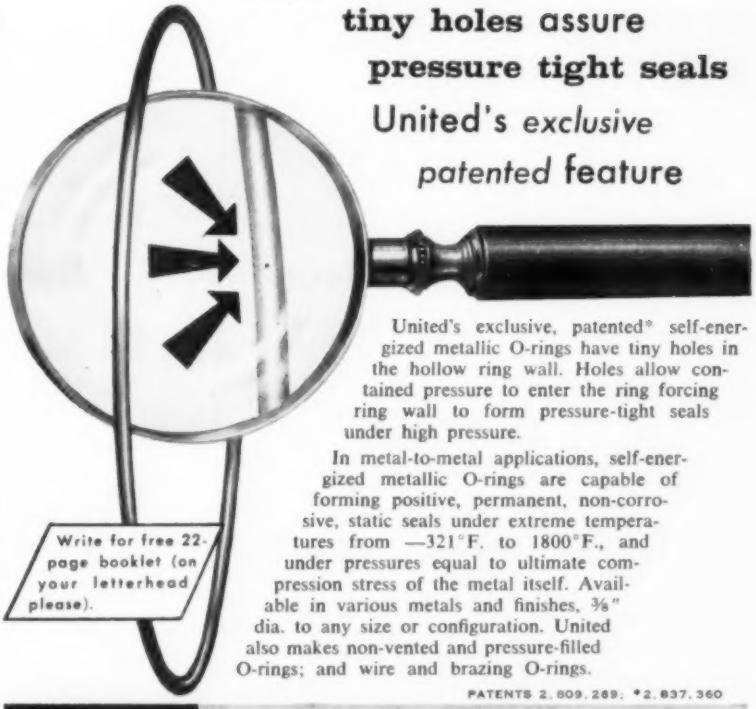
ficient, with 2-5-micron rating. Flowmeter has an error of less than 2 percent for full range of flow. Oil temperature is controlled with an air heat exchanger. An accumulator in the line reduces pressure fluctuations.—*The Rucker Co., Oakland, Calif.*

CIRCLE 513 ON TIME-SAVER CARD

CIRCLE 101 ON TIME-SAVER CARD

tiny holes assure pressure tight seals

United's *exclusive patented* feature



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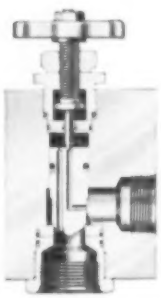
Best for extra fine metering. Micrometer adjustment, precision taper stem. 5000 psi service –65° to 350°F., oil, water, etc. Brass, aluminum alloy, steel, or stainless steel body. $\frac{1}{8}$" and $\frac{1}{4}$" sizes. Premolded or O-ring packing. Panel mounting.



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1. Store oil drums on their sides and under cover. This way water can't collect on the top and work through the bung seal. To avoid condensation in storage, protect drums against sudden temperature change and keep them full by combining partly empty drums.

2. Before opening a drum, wipe the top carefully so dirt will not fall in.

   Make certain oil containers are clean.

4. If oil drawn out of storage is not used immediately, keep it tightly covered.

5. Before adding oil to a hydraulic system, wipe off the fill plug and funnel with clean, lint-free rags.

6. Strain oil through 120-mesh or finer filter when filling reservoirs.

7. Don't forget to close the reservoir openings tightly.

8. Be sure oil drums are plainly marked to avoid mixup. ▼▼▼

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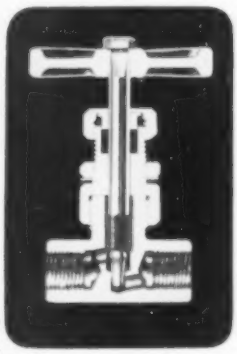

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. . . saves power

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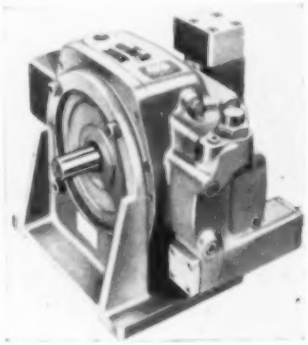
Features: When preset pressure is reached on the work, a hydraulic control reduces pump volume to slip stroke and holds the pressure which reduces heat and saves power. The pump uses radial rolling pistons and a balanced flat valve plate. Other features are, separate wear plate, integral adjustable volume and pressure unloading control, one piece cylinder and shaft, and large anti-friction bearings.



Specifications: Clockwise or counter-clockwise rotation. Face, right angle bracket or adapter mounting. Working pressures to 1100 psi. Delivery at 1750 rpm, 3100 cipm. Weight, 130 lbs.

The Oilgear Co.
Milwaukee, Wis.

CIRCLE 306 ON TIME-SAVER CARD

PILOT CHECK VALVE

. . . prevents cylinder creep

Operation: Pressure at inlet port raises poppet allowing flow to extend cylinder. Reverse flow is shut off when poppet seats. Pilot port is piped to other end of cylinder. When pressure is applied to this line pilot push rod lifts poppet and allows reverse flow.

Specifications: Pilot lifts poppet with 30% of line pressure at pilot port. Working pressure 3000 psi. Temperature range —65 to 250 F. Aluminum body and stainless steel trim. Made in sizes to ¾-in.

Republic Mfg. Co.
Cleveland, Ohio

CIRCLE 307 ON TIME-SAVER CARD

NYLON AIR HOSE

. . . has snap-back action

Designation: Nycoil

Features: Will withstand high pressure and is abrasion and chemical resistant. Spring action keeps hose out of operator's way. Smooth inside surface gives low resistance to air flow.

Specifications: Made in 3/16 and ¼-in. ID in standard 25-ft lengths, with flare fittings on each end.

Nycoil Co.
Westfield, N. J.

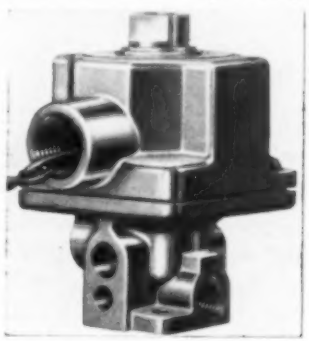
CIRCLE 308 ON TIME-SAVER CARD

THREE-WAY VALVES

. . . for fast cycling

Designation: A series

Design: Valve plunger is spring-loaded and direct-acting. Soft synthetic seats are used to give bubble-tight sealing. It is normally closed and has a 5/32-inch orifice with ¼-inch ports.



Specifications: Valve weighs only 3 lb and is 3⅞ in. high by 2⅜ in. square. The body and mounting are zinc and internal parts are stainless steel.

Skinner Electric Valve Div.
New Britain, Conn.

CIRCLE 309 ON TIME-SAVER CARD

DIAPHRAGM VALVES

. . . give fast response

Features: Valves are direct acting globe type for air or water service. They offer leak-free perform-

Victor Regulators control high pressure gases...safely and accurately

GD700 SERIES for testing pneumatic components or operating gas systems. Gas-O-Dome primary regulator is controlled by a relief venting, high pressure, spring loaded regulator. This combination offers you precise regulation for both low or high volume applications.

MODEL	PSI MAX. INLET	PSI OUTLET RANGE	GAUGES (integral or panel mounting)
GD710	7000	400-7000	10,000-10,000
GD711	7000	200-3600	10,000- 5,000
GD712	7000	200-2000	10,000- 4,000
GD713	7000	50- 800	10,000- 1,000
GD714	7000	10- 150	10,000- 200
GD700	3600	200-3600	5,000- 5,000
GD701	3600	200-2000	5,000- 4,000
GD702	3600	50- 800	5,000- 1,000
GD703	3600	10- 150	5,000- 200

Flow: Approx. 300 scfm. Leakage: None.
Operating temp. range: −67° F to +200° F (Storage −80° F)

LR SERIES Loading Regulators for "dead end" and low capacity testing (2 sfcm.) of pneumatic components, or for operating gas systems. Will hold dead-end pressures without leakage—also will hold supply pressure even when inlet pressure decreases.

MODEL	PSI MAX. INLET	PSI OUTLET RANGE
LR20B	7000	40-7000
LR19B	7000	20-3600
LR18B	7000	15-2000
LR17B	7000	10- 800
LR16B	7000	5- 200

Operating Temp. Range: −67° F to +200° F (Storage −80° F)
Leakage: None.

BOTH GD700 AND LR SERIES are field proved. They regulate all non-corrosive gases, including oxygen. Forged bronze bodies; stainless steel trim; Kel-F seats; internal filters; built-in adjustable relief. Proof pressure 2 times rated pressure; burst pressure 3 times rated pressure. Panel mounting. Stainless steel models available for corrosive gases. For complete specifications, write us today.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

47

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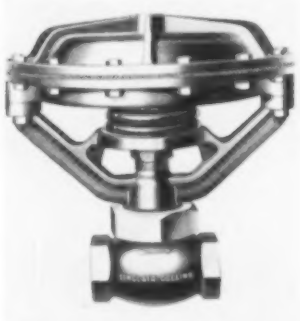
CIRCLE 106 ON READER SERVICE CARD

J. C. Menzies & Co., Wholly-Owned Subsidiary

NEW PRODUCTS

ance, fast response, and long service life.

Design: Bodies are Navy M bronze and top guided stem and disc are



K-monel. Replaceable seat ring is hardened and ground stainless steel and is lapped at assembly. Teflon-asbestos packing prevents leaks at the stem.

Specifications: Made in two series, for 150 and 300 psi service in ¼ to 3-inch pipe size. Diaphragm tops are designed for air at 30 to 35 psi.

The Sinclair-Collins Valve Co.
Akron, Ohio

CIRCLE 310 ON TIME-SAVER CARD

COMPRESSOR RINGS
. . . of molded Teflon

Designations: Fluorogreen L

Features: Have step cut joints and use steel expanders to hold proper pressure. Made of Teflon molded with micro-sized glass fibers to insure uniform density. Will operate at temperatures to 400 F and require no lubrication. Can be used to change pumps and compressors

from lubricated to non-lubricated. Made in diameters to 30 in.

John L. Dore Co.
Houston, Texas

CIRCLE 311 ON TIME-SAVER CARD

ROTARY AIR MOTOR
. . . for speeds to 20,000 rpm

Designation: 71A-1

Features: Compact design, 7⅛ in. long and 1⅛ in. dia. Starts and

stops quickly. Built for continuous operation. Will deliver up to ⅛ hp and 36 inch-lb stall torque. An adjustable plug-type regulating valve is used for changing speed. Designed for end-mounting with two ¼-inch machine screws.

Gardner-Denver Co.
Quincy, Ill.

CIRCLE 312 ON TIME-SAVER CARD

POWER STEERING PUMP
. . . saves engine space

Designation: VT-33

Features: Driven directly by the crankshaft pump eliminates the need for pulleys and belt. It also assures more positive steering power by removing the chance of belt

For long-lived high performance, get

GAST ROTARY AIR PUMPS

Here's the broad Gast Line of Air Compressors. Vacuum Pumps, too, are made in all these models. Capacities from .6 to 45 cfm., pressures to 30 psi., vacuum to 28" Hg. Rotary-vane design is simple, efficient, dependable. Positive, pulseless air delivery—no tank needed. For plant use or O.E.M., *get Gast quality!*

Write for Gast Catalog; describe your specific needs.

GAST MANUFACTURING CORP., P.O. Box 117-D
Benton Harbor, Michigan

See Catalog in Sweet's Design File

GAST ROTARY

- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

"Air may be your answer!"

CIRCLE 45 ON TIME-SAVER CARD

THE ORIGINAL MONOPAK—CARTRIDGE

A complete packing unit for hydraulic or pneumatic rods or cylinders.

- **Easily installed or replaced.**
- **Needs no adjusting.**
- **Reduces initial machining expense.**
- **Longer service life.**
- **Includes "Seal-Guard" rod wiper.**
- **Low friction coefficient.**
- **Shock and burst proof.**
- **Cuts machine down-time.**

**Detailed literature on request.*

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

CIRCLE 57 ON TIME-SAVER CARD

slippage. Pump is vane type construction that has been widely used for power steering.

Specifications: It will operate

through a speed range of 425 to 4600 rpm. Capacity at 1200 rpm is 6.9 gpm. It has a built-in flow control and relief valve set at 1000 psi. Weight, 12 lb.

Vickers Inc.
Detroit, Mich.
CIRCLE 313 ON TIME-SAVER CARD

MICROMETER HAND-WHEEL
. . . for metering valves

Designation: 280-25

Design: Hand-wheel is furnished in kit form and is for use with the companys' 280 series metering

valves. It gives the measurement of valve settings by establishing a reference point as to the number of turns the valve stem requires to obtain a particular flow. Kit contains necessary parts and installation and operating instructions.

Hoke Inc.
Englewood, N. J.
CIRCLE 314 ON TIME-SAVER CARD

MINIATURE SOLENOID VALVE
. . . in stainless steel

Features: Unique magnetic structure permits higher pressures and greater flows. A soft synthetic plunger and welded joints prevent leaks. Can be installed in any position. Coils are made for all voltages. Only two moving parts, and packless construction reduce maintenance.

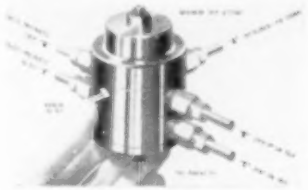
Specifications: Made in 2 and 3-way types for pressures to 400 psi, normally open or normally closed.

Allied Control Co., Inc.
Valve Div.
New York, N. Y.
CIRCLE 315 ON TIME-SAVER CARD

CONTROL INSTRUMENT
. . . tripped by air signal

Designation: Mite-73.

Operation: A monitor instrument which trips when air pressure reaches its minimum or maximum setting. It remains tripped after pressure is returned to normal, un-



til manually reset either locally or remotely. When tripped it can be made to either vent to atmosphere or shut off air supply.

Specifications: Maximum pressure

The ARROW AUTOPNEUMATIC CONTROL is the answer to your compressed air problems

Write for Free Catalog

ARROW TOOLS, INC.
1934 S. Kostner Ave.
Chicago 23, Illinois

CIRCLE 10 ON TIME-SAVER CARD

NEW PRODUCTS

250 psi. Minimum trip adjustment 1 to 100 psi.

George W. Dahl Co., Inc.
Bristol, R. I.

CIRCLE 316 ON TIME-SAVER CARD

SERVOAMPLIFIER
. . . has fast response

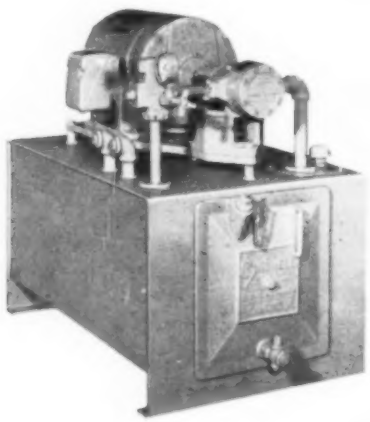
Designation: Model 601

Features: Will drive DC torque motors or accept feedback signals from AC or DC pickups. Test jacks allow use of external scope to check wave form and phase. Independent level and balance controls enable the current to run from 8 to 25 ma without interaction, speeding up servo-loop adjustments. The integral carrier amplifier consists of a local oscillator, quadrature rejector, phase shifter, amplifier, synchronous demodulator and filter circuit.

American Measurement and Control, Inc.
Waltham, Mass

CIRCLE 317 ON TIME-SAVER CARD

CARDWELL STANDARD HYDRAULIC POWER UNIT



SEVERAL HUNDRED POSSIBILITIES! Now, from one Cardwell Catalog, you can specify a "tailored-to-fit" Hydraulic Power Unit from a combination of Cardwell standard parts.

WRITE TODAY for this catalog which describes the new Cardwell Hydraulic Program in detail, including drawings, specifications and price sheets.

DEALERS and DISTRIBUTORS will want this new program, too! One catalog gives you a complete line of Standard Hydraulic Power Units. Write or phone . . .

The CARDWELL MACHINE COMPANY
Franklin at 19th St., Richmond 11, Virginia • Phone Milton 4-4593

AIR CONTROL VALVES
. . . for remote pilot operation

Designation: Hi-speed inline

Features: The 2 and 3-way valves have instantaneous response, due to short poppet travel. Shorter machine cycle time results from this fast response. Valves were designed for operating high speed brakes and clutches. They can be controlled by a remote or integral pilot.

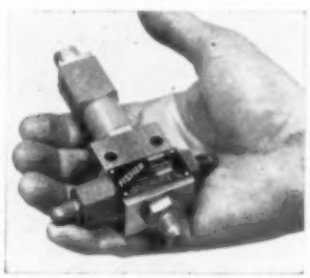
Specifications: Working pressures range from 20 to 250 psi for remote operation, but valves will work with main valve pressures down to 6 psi Sizes from ⅜ to 1½-in. NPT in both 2 and 3-way.

Valvair Corporation
Akron, Ohio

CIRCLE 318 ON TIME-SAVER CARD

DIFFERENTIAL PRESSURE SWITCH
. . . weighs only 6 oz

Features: Designed for hydraulic and pneumatic systems this unit will measure a pressure difference from 10 to 2000 psi in a system to 5000 psi. Vibration or jarring does not affect it. An externally adjusted spring controls the differential.



Specifications: Standard units with ¼ in male tube or pipe connections are available from stock. Switches will operate from —65 to 165 F and have an electrical rating of 15 amps at 120 v.

Fisher Controls Inc.
Santa Monica, Calif.

CIRCLE 319 ON TIME-SAVER CARD

ROCKRITE® TUBING—

"As Supplied"—
Ideal for cylinder applications

- costs less per finished pound—
- no processing of inside diameters—
- usable as supplied—
- overnight shipment from regional steel service centers—

ROCKRITE cylinder-finish, seamless tubing was developed expressly for cylinder application. Cold working by the ROCKRITE method imparts higher mechanical properties and exceptional machining qualities. Increased packing life will be obtained from ROCKRITE cylinder-finish tubing.

Stocked by leading steel service centers throughout the country. Immediately available in quantity in a complete range of standard sizes. Contact your leading tube distributor for one piece to a carload.

Write today for Bulletin R-10 that describes ROCKRITE tubing.

ROCKRITE® TUBING

TUBE REDUCING CORPORATION
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Mailing address: P. O. Box 959A, Passaic, N. J.

CIRCLE 100 ON TIME-SAVER CARD

2nd printing now available

AIRCRAFT HYDRAULIC DESIGN

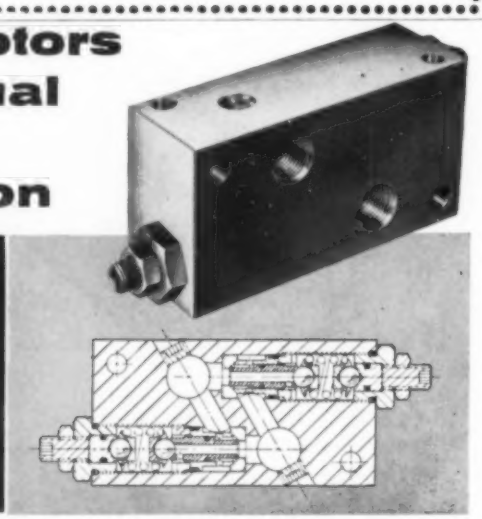
• **The first book** dealing with hydraulic component and system design for high-speed piloted aircraft and missiles, has been written by a leading aircraft engineer. Developed from practical and theoretical material, the book develops many basic equations including those relating pressure gradient, flow-path dimensions, flow rate, velocity, fluid density, and viscosity.

$4.50

10 or more $4.00 per copy

The Industrial Publishing Corporation
812 Huron Road — Cleveland 15, Ohio

Fluid Motors Need Dual Relief Protection



DUAL RELIEF VALVES

■ **Prevent excessive pressures at motor ports when valves are suddenly reversed or blocked.**

■ **Assure smooth safe starting or deceleration of large loads.**

- Pressure on one side may be set higher than on the other
- For Oil
- 100 to 3000 psi
- ⅜", ½" & ¾" pipe sizes

Write for detailed information and prices.

Fluid Controls, inc.

Member Of Fluid Power Association

Manufacturers of Hydraulic Valves and Devices

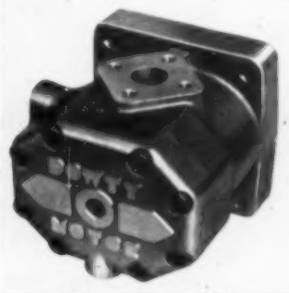
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

NEW PRODUCTS

GEAR MOTORS
. . . are pressure balanced

Design: Motors are made with outputs to 30 hp and efficiencies to 80%. Speed range is 300 to 3000 rpm. The gears are pressure balanced by feeding inlet pressure to



the outer end of a pair of bushes in the pump cartridge. O-ring seals limit the area on which the pressure acts, so that a controlled force, slightly greater than the load tending to open the bushes, holds them in contact with the gears. Plain bearings are used and are lubricated by a metered quantity of fluid.

Motors are made for flange or foot mounting and can be furnished with straight or elbow pipe connections.

Dowty Hydraulic Units Ltd.
Ashchurch, Glos.

CIRCLE 320 ON TIME-SAVER CARD

CHECK AND FLOW CONTROL VALVES
. . . have high flow rates

Features: Valves are for hydraulic or air service and have pressure ratings of 2000 psi. A straight-

through ball design gives increased flow and reduces friction. Sensitive adjustment is acquired by adjusting the valve ball rather than the passage.

Specifications: Valves have female Dryseal threads from ⅛ to ¾ inch

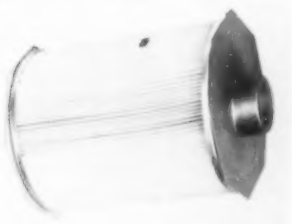
and are made in brass, steel, aluminum, and stainless steel. They can be used at very high or low temperatures since there are no internal gaskets or hinged parts.

True Flow Valve Div.
Mystic Machine Co., Inc.
Everett, Mass.

CIRCLE 321 ON TIME-SAVER CARD

SUCTION FILTER
. . . has ten micron rating

Features: Resin-impregnated cellulose, accordian-pleated gives large



filtering area. Filter mounting structure is all stainless steel.

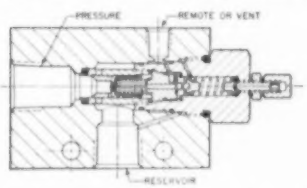
Specifications: Made in 7.5, 15, and 30 gpm sizes.

Kahn and Co.
Hartford, Conn.

CIRCLE 322 ON TIME-SAVER CARD

PILOT RELIEF VALVE
. . . has high capacity

Features: Close control of system pressure over wide range. Crack-



ing pressure is over 90% of maximum relief pressure.

Operation: A remote pilot valve is set to open at the pressure required by the circuit. The sliding spool main valve is held closed by the balanced pressure across an orifice in the spool. When the remote valve opens, pilot flow passes through the spool and relieves the main valve to tank.

Specifications: Sizes of ½, ¾, and 1-inch NPT. Pressures to 3000 psi.

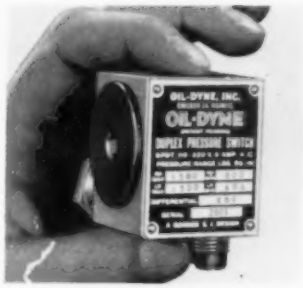
Fluid Controls Inc.
Mentor, Ohio

CIRCLE 323 ON TIME-SAVER CARD

DUPLEX PRESSURE SWITCH
. . . has two pressure settings

Features: Two separate pressure ports can be joined with an adapter plate to allow one port to serve both switches. They are shock and vibration resistant. A new patented seal, and use of low-friction materials eliminate piston sticking and make it sensitive.

Specifications: Made for pressures to 5000 psi. Two separate single-pole, double throw switching elements are rated at 5 amp. Standard wiring is normally closed but



any combination can be supplied.

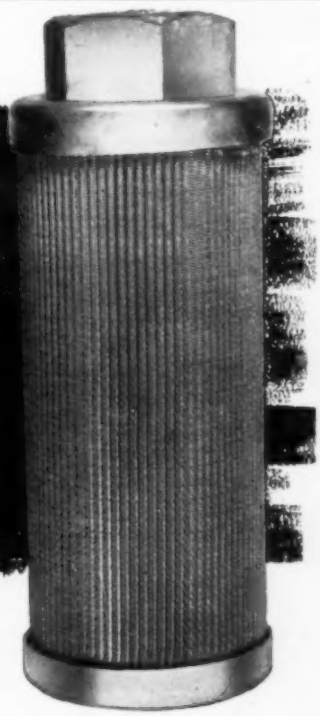
Oil-Dyne, Inc.
Chicago, Ill.

CIRCLE 324 ON TIME-SAVER CARD

Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

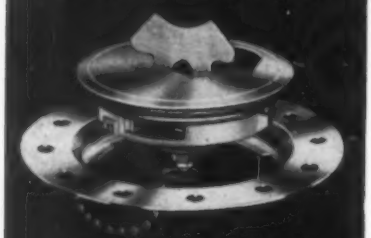
CAPITAL ENGINEERING & MFG. CORP.
5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

CIRCLE 19 ON TIME-SAVER CARD

CIRCLE 43 ON TIME-SAVER CARD

GABB

FC-3500



TANK FILLER CAP

The Model FC-3500 is the first tank filler cap to successfully pass all test requirements of MIL-C-7244B (ASG) applicable to fuel, oil, alcohol-water and hydraulic reservoirs.
Lever action design permits cap to be opened safely under pressure and removed completely with only a 35° turn. Now available in 1.5, 2, 3, and 3.82" openings.

Write for free literature.

GABB SPECIAL PRODUCTS Inc.
WINDSOR LOCKS, CONN.

free catalog

ALLEN AIR VALVES

Technical catalog (with prices listed) — yours for the asking.

WRITE BEFORE NEXT TUESDAY

The A. K. ALLEN CO. AH-8-Y
255 East 2nd St., Mineola, N. Y.

Name .....
Company .....
Address .....
City ..... Zone ..... State .....

USEFUL LITERATURE

HYDRAULIC CYLINDERS . . . designed to meet or exceed JIC standards are illustrated in a brochure offered by *The Sheffer Corporation, Cincinnati, Ohio.* All steel construction, these cylinders are made in 1⅛ to 12 inch bore sizes for 2000-3000 psi operating pressure. Mounting and dimensional data is charted. Engineering data for this C4H series is included.

CIRCLE 420 ON TIME-SAVER CARD

AIR CYLINDERS . . . the C10 series are shown in a catalog issued by *The Sheffer Corporation, Cincinnati, Ohio.* Complete information is given on construction, dimensions, packings, cushions and mountings.

CIRCLE 421 ON TIME-SAVER CARD

PLASTIC PRODUCTS CATALOG . . . issued by *Raybestos-Manhattan, Inc., Manheim, Pa.* covers their complete line of products made from Teflon, Raylon and Kel-F. Of particular interest to designers of hydraulic and pneumatic systems is the information on hose, O-Rings, packings, and back-up rings.

CIRCLE 422 ON TIME-SAVER CARD

NEW VALVE LINE . . . introduced by *Dukes Hydraulics, Schiller Park, Ill.* is described in 12-page Bulletin 171. Dimensional drawings are included for manual, stem operated, cam operated, air piloted, oil piloted, and pilot operated-solenoid controlled directional valves. JIC symbols illustrate spool configurations for these 3000 psi, 12 gpm and 18 gpm hydraulic control valves.

CIRCLE 423 ON TIME-SAVER CARD

HYDRAULIC STARTER . . . for mobile and stationary engines operates at 3000 psi. Application, design and operation of this hydraulic package is detailed in a 14-page manual released by *American Bosch Division, Springfield, Mass.* Curves compare performance of hydraulic, pneumatic and electric starters. System includes; hydraulic cranking motor, starter control valve, hydraulic pump, unloading valve, and accumulator. Selection charts and installation drawings are shown.

CIRCLE 424 ON TIME-SAVER CARD

65 GPM VALVES . . . manufactured by *Parker Hydraulics Division, Parker-Hannifin Corp., Cleveland, Ohio,* are described in Catalog 1553A50. These directional control valves for mobile equipment come in 1-, 2-, and 3-spool models. Catalog shows construction features, pressure drop curves, dimensional data and operating positions for these 2000 psi valves. Drawings show symmetrical bodies which permit operating spools and integral relief valves to be assembled from either end. Valves have SAE split flange connections.

CIRCLE 425 ON TIME-SAVER CARD

TEFLON NOTES . . . tells what Teflon is and how it performs. *E. I. du Pont, Wilmington, Dela.* publishes these notes to supply their field salesman with information to aid them in selling and servicing their customers. Copies of these notes are available. Issue 15 uses a question and answer format.

CIRCLE 426 ON TIME-SAVER CARD

HOSE AND TUBE COUPLINGS . . . of quick-connect and quick-disconnect design are shown in a new general catalog issued by *Snap-Tite, Inc., Union, City, Pa.* The five basic Snap-Tite couplings shown include the "H" couplings for high pressure applications; the "JH" coupling for impact in air lines; the "Hi-Flow" coupling for low pressure applications; the "E" coupling for vacuum and very low pressures and the "T" coupling for hard to handle fluids. Construction, flow and pressure drop data are given.

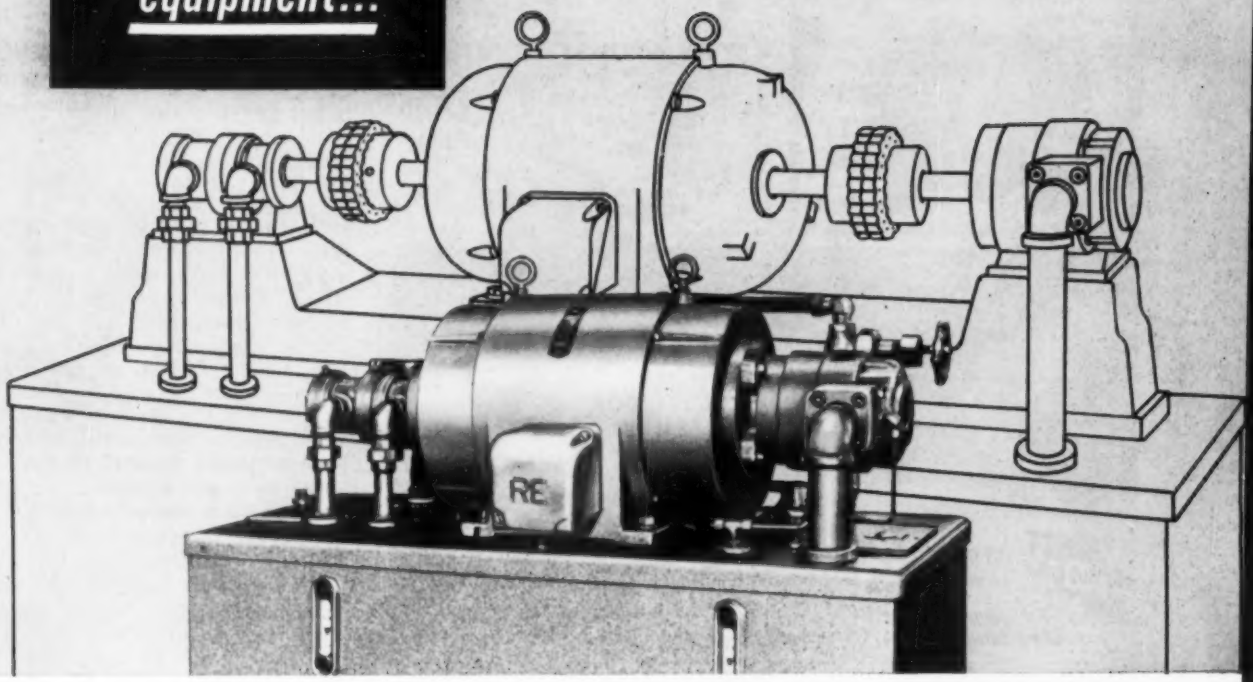
CIRCLE 427 ON TIME-SAVER CARD

AIR FILTERS . . . with a porous stone element are shown in a sheet available from *H. O. Trerice Company, Detroit, Mich.* Principles of operation are described; typical installation drawing included, and a chart gives capacities, dimensions and prices.

CIRCLE 428 ON TIME-SAVER CARD

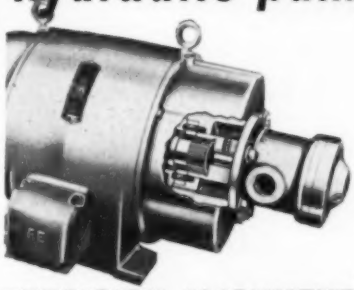
CIRCLE 117 →

If you use or sell hydraulic equipment...



...cut space needs almost 50% with REULAND spline-coupled hydraulic pump mount motors!

Pump and motor become *one* with the new Reuland spline-coupled hydraulic pump hook-up. The pump shaft is connected directly to the motor's shaft *inside the motor.* Flexible couplings are eliminated... pump mount platforms are eliminated... and the tank length can be reduced because almost 50% less mounting area is required. Compact appearance is beautiful.



SPEEDY INSTALLATION

Pump-to-motor hook-up is merely a matter of seconds. All you do is slip the spline coupling onto the pump shaft...and attach the pump to the endbell. This spline coupling is supplied with the motor and is precision mated for each make of pump. There's no time wasted tinkering around...takes only a fraction of the ordinary time.

PRECISION ALIGNMENT

Alignment is perfect *automatically* whether the installation is made out in the field or on the production line. This permits even unskilled workmen to handle this simple task without error. Also, by hooking the pump up at the point of bearing support, within the motor, vibration is reduced to a new minimum. Operation is smooth, quiet.

COSTS LESS...SAVES INSTALLATION LABOR... FITS ALL PUMPS

The Reuland spline-coupled unit is priced lower than a conventional set-up... saves you extra money by reducing installation costs. What's more, we can supply it to fit any make of pump you may be using. So sure are we that it will be of help to you, we are offering to engineer a demonstration unit to *your* equipment, without the slightest obligation. These units are our best salesmen.

OUR NEW GENERAL CATALOG WILL COME IN HANDY–SENT FREE ON REQUEST.

MODERN POWER FOR MODERN-DAY PRODUCTS

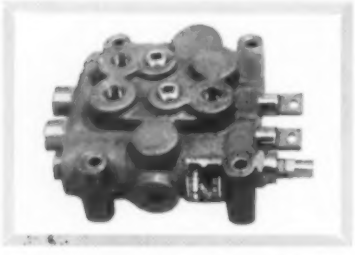
REULAND MOTORS

REULAND ELECTRIC COMPANY
WESTERN DIVISION: Alhambra, California
EASTERN DIVISION: Howell, Michigan
DISTRIBUTORS IN ALL PRINCIPAL CITIES

*Trademark Registered

CIRCLE 59 ON TIME-SAVER CARD

HUSCO
HYDRAULIC CONTROLS
ARE SPACE-SAVERS



Here's new compactness in a multiple-purpose Hydraulic Control Valve—Husco No. 3600. Its simplified balanced design provides for single or double-acting plungers, individual check valves for each, adjustable relief valve with or without float position and alternate high pressure carry-over. Sizes, 5 to 60 gallons per minute.

Check HUSCO *first* for modern Hydraulic Units, and engineering aid on all your hydraulic developments. Write for details.

HUSCO **HYDRAULIC UNIT SPECIALTIES CO.**
Pumps • Valves • Cylinders
P. O. Box 257-A, Waukesha, Wis.

USEFUL LITERATURE

TUBE FITTINGS . . . in ¼ to 1-inch sizes for hydraulic systems are fully described in a 34-page catalog published by *Mayfair Industries, Inc., Chicago, Ill.* Parts numbering system, pressure ratings design features, applications and dimensional data are given for these "Collet Grip" fittings which meet JIC specifications. Sectional drawings show construction of these flare type fittings.

CIRCLE 429 ON TIME-SAVER CARD

FACT BOOK . . . for selecting Quad and O-rings is the title of a 16-page manual recently published by *Minnesota Rubber Co., Minneapolis, Minn.* This new aid for engineers charts size numbers and dimensions of all common industrial O-rings and the exclusive Minnesota Rubber Quad Ring. These sizes are cross indexed for easy comparison with many of the commonly used military dimensional specifications. Quick reference charts cover aeronautical material specifications, SAR-ASTM material specifications, Mil-R-5847C specifications, U.L. approved rubber compounds, and applications.

CIRCLE 430 ON TIME-SAVER CARD

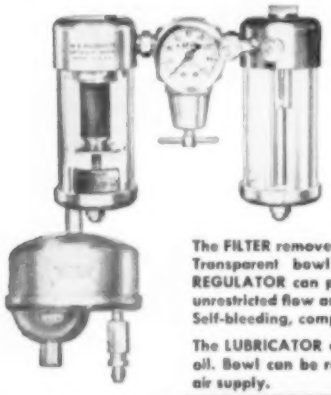
HIGH SPEED VANE PUMP . . . will operate at 2000 rpm and pressures to 2000 psi. It's described in Bulletin M5108 issued by *Vickers Incorporated, Detroit, Mich.* Developed for mobile equipment, the pump offers increased power for accessory operation while making savings in space and weight. Performance characteristics are tabulated for the six models delivering 17.8 to 43.0 gpm. Also included in the bulletin are series V4240 double pumps and new series V300 and V440 vane pumps which have been redesigned to operate at the higher speed and pressure.

CIRCLE 431 ON TIME-SAVER CARD

BALL VALVES . . . their materials, construction and operation are given in a catalog of data sheets

GREATER PROTECTION to your AIR LINE!
M-B

WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY AND AUTOMATIC AIR TRAP (MODEL W-4)



SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M-B PRODUCTS
46 VICTOR AVE., Div. 10
DETROIT 3, MICHIGAN

SOLVES tooling and automation problems **ECONOMICALLY!**

IMPROVED!
1-⅛" bore **CLH SERIES** clamp-type Hydraulic Cylinders

The ideal cylinder for unlimited automation, tooling and production line applications where space and economy are important! Compact—only 1⅝" square. Pre-stressed construction for rough service. Double acting, or spring return. Universal, or pivot mount. Rods and pistons hard chrome plated. Heads machined from square bar stock. Immediate delivery on 1", 2" and 3" strokes. Fractional or longer strokes available. 1500 psi hydraulic; 250 psi air.

Write NOW for NEW Bulletin No. 758

SHEFFER
THE SHEFFER CORPORATION
Cincinnati 15, Ohio • Phone: VAlley 1-0320

Manufacturers of the Industry's most complete line of air and hydraulic cylinders

SOLD BY LEADING DISTRIBUTORS NATIONWIDE

CIRCLE 69 ON TIME-SAVER CARD

CIRCLE 87 ON TIME-SAVER CARD

prepared by *Jamesbury Corp., Worcester, Mass.* These on-off valves handle a broad line of fluids including compressed air and hydraulic oil. Made in sizes from ¼ to 8 inches, these valves require only quarter-turn operation.

CIRCLE 432 ON TIME-SAVER CARD

SHAFT COUPLINGS . . . now made in ten sizes to handle shaft diameters from ⅜ to 2⅞ inches are described in bulletin 10100A issued by *T. B. Wood's Sons Co., Chambersburg, Pa.* Selection data and other engineering tables have been revised to include the new large and small coupling sizes. Revised tables include newly designed couplings with ductile-iron flanges and a special steel retaining ring and specially balanced couplings.

CIRCLE 433 ON TIME-SAVER CARD

HYDRAULIC SERVO VALVE . . . its design and performance data are covered in bulletin 5801. Developed by *Pesco Products Division, Borg-Warner Corp., Bedford, Ohio,* this 11 ounce valve is rated at 7 gpm to operate at pressures to 3000 psi over a temperature range of —65 to 400F. Included in the bulletin are detailed descriptions of the servo valve operation and of the components in the basic valve design. Performance advantages and a detailed dimensional drawing are shown along with applicable military specifications. Operational performance curves give information on load pressure sensitivity, dynamic response characteristics and differential current vs flow.

CIRCLE 434 ON TIME-SAVER CARD

MINIATURE AIR COMPONENTS . . . which include cylinders, valves, solenoids, manifolds, fittings and accessories are shown in a new 4-page bulletin offered by *Clippard Instrument Laboratory, Inc., Cincinnati, Ohio.* A flow chart and typical "in use" application are included.

CIRCLE 435 ON TIME-SAVER CARD

GAUGE SAVER . . . which can increase the life and service from pressure gauges and pressure switches is illustrated in a catalog sheet prepared by *Sprague Engineering Corp., Gardena, Calif.* Available in six models, these automatic shut-off valves offer pressure ranges from 10 to 10,000 psi for both hydraulic and pneumatic service. Sheet gives mounting, maintenance and adjustment instructions.

CIRCLE 436 ON TIME-SAVER CARD

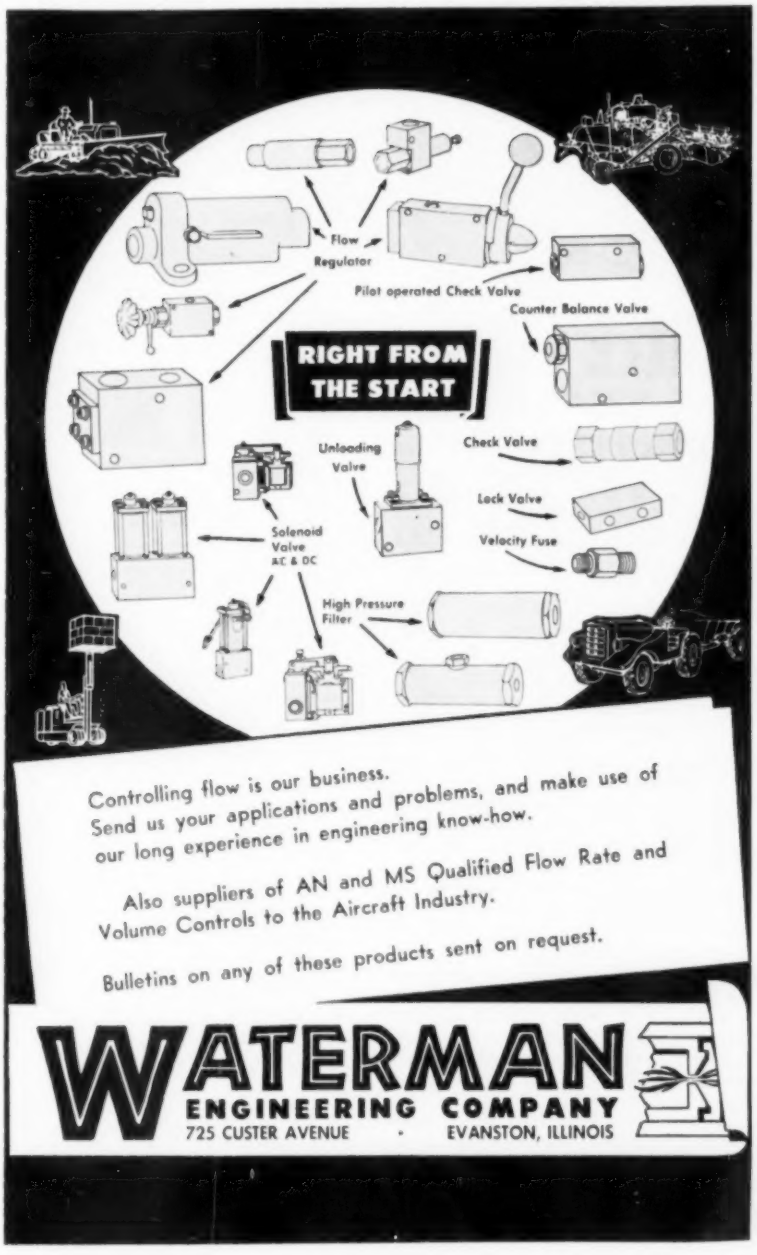
SEALS FOR ROTATING SHAFTS . . . and sealing problems are discussed in a spiral bound booklet available from *Rotary Seal Division, Sparta, Mich.* Typical sealing problems are shown in engineering drawings; the rotary seal principle is analyzed, and plant facilities are described.

CIRCLE 437 ON TIME-SAVER CARD

FLEXIBLE SHAFT COUPLING . . . for driving air compressors and hydraulic pumps is described in reference manual C-5 offered by *Sier-Bath Gear and Pump Company, North Bergen, New Jersey.* Types and sizes are charted. Installation information, applications and selection data are included in this 18-page booklet.

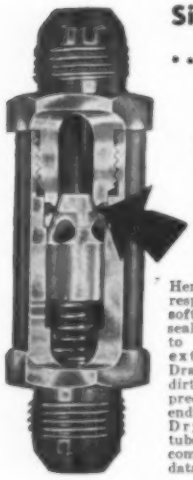
CIRCLE 438 ON TIME-SAVER CARD

Use a Time Saver Card between pages 96-97


Flow Regulator
Pilot operated Check Valve
Counter Balance Valve
RIGHT FROM THE START
Unloading Valve
Check Valve
Lock Valve
Solenoid Valve AC & DC
Velocity Fuse
High Pressure Filter
Controlling flow is our business.
Send us your applications and problems, and make use of our long experience in engineering know-how.
Also suppliers of AN and MS Qualified Flow Rate and Volume Controls to the Aircraft Industry.
Bulletins on any of these products sent on request.
WATERMAN
ENGINEERING COMPANY
725 CUSTER AVENUE · EVANSTON, ILLINOIS

CIRCLE 108 ON TIME-SAVER CARD

CIRCLE 64 ON TIME-SAVER CARD



Simple, Secure ... Leak-Tight! this FLEXIBLE SEAL SEAT*

Here's the secret . . . responsive action of the soft, long-lasting O-ring seal! Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts or extra end seals. Six standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Send for data sheet.

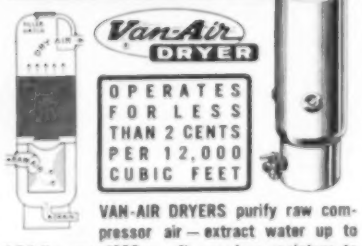
KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

COMPRESSED AIR DRYERS AND CLEANERS



VAN-AIR DRYERS purify raw compressor air — extract water up to 1.07 lbs. per 1000 cu. ft. — reduce moisture to ZERO-dewpoint — remove contaminating bacteria, scale, etc. — deliver air uniformly clean and dry.

VAN-AIR DRYERS have no elements to heat, regenerate or regulate — average ten minutes care per month — process air automatically with a non-corrosive desiccant (see diagram) — operate with less than 1% pressure drop.

Many plants, shops and labs use the VAN-AIR to protect instruments, testers, circuits, etc. Others use it to prevent fouling of chemicals, compounds, plastics, foods, drugs, etc. Some need it to reduce spoilage in product finishing, spraying, blasting, packaging, assembling, etc. Capacities range up to 8000 scfm, 6000 psig.

See it in action, Van Products Booth, Instrument-Automation Exhibit, Convention Hall, Philadelphia, Sept. 15-19. Send NOW for brochure.

VAN PRODUCTS CO. • MFRS.
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POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Thomas L. Denney was promoted to general sales manager of **The Garlock Packing Company,** Palmyra, N. Y. Denney, who assumed his new duties in May, is now charged with the administration, direction and control of field sales efforts, supervision of district managers and the coordination of sales activities between branch offices.

Thomas L. Denney Garlock Packing

W. J. Johnson Vickers-Sperry

Vickers-Sperry of Canada Ltd., has opened a new office for sales, service and repair at 150 West 1st Avenue, Vancouver, B.C. **W. J. Johnson** is manager of the new office, **A. J. MacDonald** is service representative. The expansion was due to the growing use of oil hydraulics on industrial machinery and mobile equipment in western Canada.

Tube Reducing Corp. appointed **Kenneth W. Donle** as chief engineer. Donle came to the company in 1951 as chief metallurgist. He will now direct all engineering activities.

Automatic Ohio Co., Mantua, Ohio is now representing the **Automatic Valve Company** in northern Ohio.

Col. Robert M. Burnett, USA retired, has joined **Flexonics Corporation,** Maywood, Ill. as planning coordinator and assistant to the company's president, John F. P. Farrar. Burnett will assist with planning and development of products, long term business planning and general administrative matters for the company's eight plants and national field organization.

Will Bixby has joined the sales staff of **The Paul-Munroe Co.,** Los Angeles, dealer for Rivett, Inc. Bixby has had wide experience in sales of air devices, pumps and other fluid power equipment.

Scott Equipment Company have opened their new quarters at 272 Leo Street, Dayton, Ohio. The new building, totaling 8,000 sq ft of floor space, contains a show room, warehouse space, offices and a conference room. Fluid power manufacturer's representatives since 1948, Scott Equipment have warehouses in Cincinnati, Columbus and Indianapolis.

CIRCLE 50 ON TIME-SAVER CARD

NEW

SINGLE OR 2-SPOOL VALVE

MODEL WP

PARALLEL VALVE

for heavy duty industrial mobile hydraulic applications

GRESEN HYDRAULICS

Capacity: **40 GPM** at 20 ft./sec.

MAX. PRESSURE: 1500 PSI

Features: **SPOOLS** – fully balanced, self centering, accurately feathered for fine metering action – separate ball checks for each spool.

CARTRIDGE type relief valve has hardened seat.

TRIPOD mounting feet for easy installation.

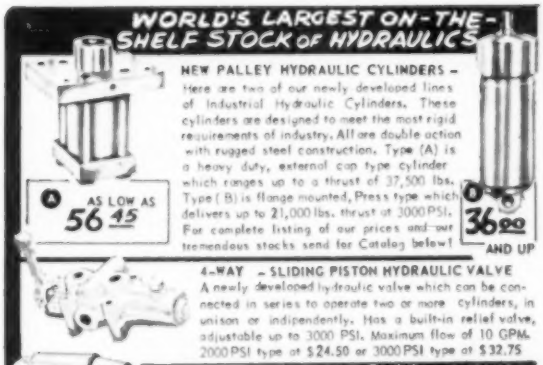
CHOICE of many modifications.

WRITE FOR LITERATURE

GRESEN *Mfg. Co.*

405 35th Ave. N.E., Minneapolis 8, Minn.

WORLD'S LARGEST ON-THE-SHELF STOCK OF HYDRAULICS



NEW PALLEY HYDRAULIC CYLINDERS – Here are two of our newly developed lines of Industrial Hydraulic Cylinders. These cylinders are designed to meet the most rigid requirements of industry. All are double action with rugged steel construction. Type (A) is a heavy duty, external cap type cylinder which ranges up to a thrust of 37,500 lbs. Type (B) is flange mounted, Press type which delivers up to 21,000 lbs. thrust at 3000 PSI. For complete listing of our prices and our tremendous stocks send for Catalog below!

(A) AS LOW AS **56.45**

(B) **36.00** AND UP

4-WAY – SLIDING PISTON HYDRAULIC VALVE

A newly developed hydraulic valve which can be connected in series to operate two or more cylinders, in unison or independently. Has a built-in relief valve, adjustable up to 3000 PSI. Maximum flow of 10 GPM. 2000 PSI type at $24.50 or 3000 PSI type at $32.75

ELECTRIC HYDRAULIC PUMP MOTORS AS LOW AS 99.50

Designed to direct-couple to aircraft type hydraulic pumps. For continuous duty with high starting torque. 115/230 V, 220/440V, 1 and 3 phase, 60 cycle A.C. Sizes from 3/4 to 15 HP. Complete details in Catalog below.

GOV'T SURPLUS BUYS

VICKERS HYDRAULIC ANGLE PUMPS

Cat. No.	GPM	PSI	RPM	Price
H-P4A	5.3	1000	3000	$22.50*
H-P5A	2.7	1500	3000	25.75*
H-P4U	6	1000	3000	22.50*

*Used but excellent condition.

SPECIAL CATALOG

396 PAGES

Shows the largest stock of Hydraulic Equip. and Supplies ever stocked under one roof. Plus elect. motors, pumps, tools, etc. Send for your copy Today and SAVE!

2000 PSI HYDRAULIC CYLINDER

SPECIAL Only 12.75

Genuine top quality Gov't Surplus. Used but excellent condition. Has a Bore of 2-1/4", Shaft 1", Stroke 4", Eye-to-eye lgth. 13½". Ports 1/4" AN.

Palley's

ORDER TODAY – Pay by Money Order or Check. ½ deposit with C.O.D.'s. All prices F.O.B. Los Angeles.

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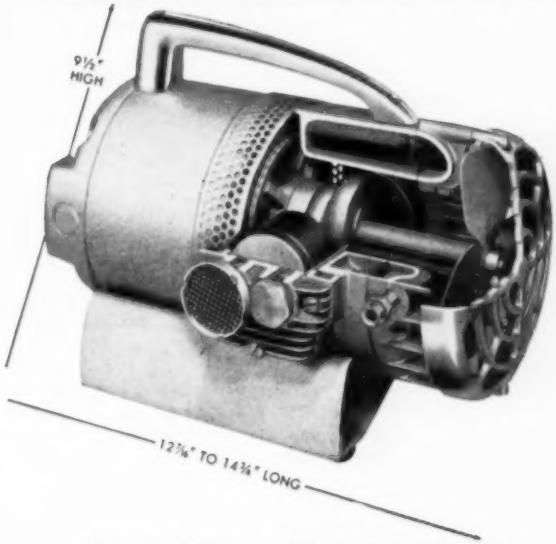
Cleaner...Drier...Cooler

Oil-Free

COMPRESSED AIR



...from this smaller compressor

No more oil-spoiled work...there's not a drop of oil in this new design, compact, lightweight unit! Motor and compressor are permanently grease-packed...graphite piston rings and skirts operate for years without destroying the mirror finish of the cylinder walls. Since the cylinders are not lubricated, oil-free air is delivered at all times, without need for an oil separator.

B&G Oil-less Compressors are really *smooth!* Modern design, large bore, short stroke, horizontally opposed pistons provide better balance and vibrationless operation. No lubrication of any kind required—no expensive lubrication maintenance. B&G Compressors are available in a complete line of portable, tank-mounted and tankless models.

Capacities: ¼ to 1½ HP. Pressures: To 190 psi. Vacuum: 27.5". Air displacement: To 13.14 CFM.

For complete information send for Catalog GO-1156.

B&G Compressor built into dry cleaning machine.

Compact, light weight B&G Compressor is easily carried.

B&G

Oil-less AIR COMPRESSORS

BELL & GOSSETT COMPANY

Dept. FJ-66, Morton Grove, Illinois

POST SCRIPTS OF INDUSTRY

Gits Bros. Manufacturing Co., Pneumatics Division, Chicago, has added four distributing organizations to handle its air line lubrication equipment. **Guarantee Specialty Co. Div.,** New York City, to cover New York area and New Jersey. **W. W. & C. F. Tucker,** Hartford, Conn., to cover Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. **H. A. Jones,** Dayton, Ohio, to cover the southern half of Ohio and bordering counties of Kentucky. **Paddon Company Inc.,** Youngstown, Ohio, to cover the Youngstown area and bordering counties in West Virginia, Maryland and Pennsylvania.

Greer Hydraulics, Inc., Jamaica, N. Y., has opened a new sales office at 1059 Tranquilla Drive, Dallas, Texas. **Fred W. Gottschling** was appointed manager of this office.

Promotion of **A. V. Causey** to general office manager of **Stratoflex, Inc.,** Fort Worth, Texas, was announced. Prior to joining Startoflex, Causey was associated with Mid-Continent Supply Co.

A. V. Causey
Stratoflex, Inc.

George G. McKhann

To provide consulting services on missile, aircraft and industrial hydraulic systems, **George G. McKhann** has opened a new office in West Los Angeles. McKhann was formerly a project engineer on hydraulics and flight controls at Wright-Patterson Air Force Base and application engineer at the Aero-Hydraulics Division of Vickers, Inc.

Commercial Shearing & Stamping Co., Youngstown, Ohio, has opened a new sales office at 1371 Peachtree Street, N.E. Atlanta, Georgia, to serve the Southeastern States. Named to head the new office as Southeastern regional manager was **George Fannon.** For the past 12 years he has been in the company's sales department.

Berry Hydraulics has added **H. S. Cain** and **R. O. Mlady** to its general office sales engineering staff in Pittsburgh, Pa.

E.C.C. Canada Ltd., representatives for **George Ellison Ltd.,** Birmingham, England, has moved to new quarters at 66 Colville Road, Toronto.

Applied Hydraulics

THE MAGAZINE OF FLUID POWER

REPRINTS

The following reprints of articles which have appeared in APPLIED HYDRAULICS Magazine are available. Please order by number, enclosing the exact amount in coins, stamps or check. Send all orders to: APPLIED HYDRAULICS MAGAZINE, 812 Huron Road, Cleveland 15, Ohio.

AVAILABLE AT 10c:

R101 **DETERMINING PUMP AND ACCUMULATOR SIZE FOR ELECTRO-HYDRAULIC SERVOMECHANISMS . . . By Paul E. Straight**
Selection of pumps and accumulators including special factors to be considered in a servo system not encountered in other industrial applications.

R102 **SPECIFYING HYDRAULIC TUBING . . . By Louis F. Calzi**
What to check when specifying tubing to avoid leakage due to cracks from vibration and pressure surges.

R103 **AIR CONTROLS OIL CIRCUITS ON A 2000-TON PRESS . . . By S. H. Durbin**
Describes use of air for pilot operation of large directional control valves for faster action.

R104 **EIGHT RULES FOR USING LIMIT SWITCHES . . . By D. Fitzpatrick**
Tells the principal causes of limit switch failures and offers methods of installation to minimize them.

R105 **WHICH HOSE FITTINGS? . . . By Jerry Taborek**
Complete information on the various types of hose ends, fittings, and port connections.

R106 **PISTON RINGS FOR HYDRAULICS . . . By Earnest J. Taschenberg and John W. Pennington**
Discuss the effectiveness of metallic piston ring seals for sealing reciprocating hydraulic pistons and gives basic information on their development and effective use.

AVAILABLE AT 25c:

R107 **GROWING HORIZONS FOR FLUID POWER . . .**
A 32-page report covering trends in design and application of fluid power.

R108 **TEMPERATURE CONTROL IN HYDRAULIC SYSTEMS . . . By Allan E. Morris**
A complete report on latest developments. Sixteen pages of data on heat generation, fluids and packings, heat dissipation, system design, oil coolers, immersion heaters, and automatic temperature control.

AVAILABLE AT 50c:

R109 **COMPONENTS FOR WATER HYDRAULICS . . . By Allan E. Morris**
A special 16-page report covering the design, selection, and sizing of pumps, valves, accumulators, packings and cylinders. The report also covers additives and air controls.

Lovejoy Flexible Coupling Co., Chicago, Ill., has acquired controlling interest in **Hi-Lo Manufacturing Co.,** formerly Equipment Engineering Co. of Minneapolis, Minn. Hi-Lo Mfg. Co. will continue operations in Minneapolis under **V. G. Nordley,** president.

Promotion of **Jack D. Tolliver** to the newly established position of sales manager for the Eastern region has been announced by **Tube Turns,** Louisville, Ky., division of Chemetron Corp. He will be succeeded as manager of the sales development department by **Edward F. Harrington.**

Sterling S. Wehner and **Carl E. Poling** have joined **Hydraquip Corp.,** Houston, Texas, as field engineers.

Vickers, Incorporated, Detroit, Mich., named **Allen Melville** as application engineer in the Chicago office, specially assigned to the application of hydrostatic transmissions for mobile equipment. Melville has had many years experience in hydraulic machinery production and installa-

Edward I. Brown
Vickers, Inc.

Allen Melville
Vickers, Inc.

tion and various service and sales capacities. **Edward I. Brown** has become director of engineering for the machinery hydraulics division. He will now be responsible for all engineering functions of the division. Prior to his new appointment he was chief engineer, Torrance plant, Aero Hydraulics Division.

James Piekarski has joined the **Ray M. Cordon Co.,** Milwaukee, as sales engineer. He will cover southern Wisconsin.

FULFLO

piston-type oil relief by-pass valves for O.E.M. or replacement

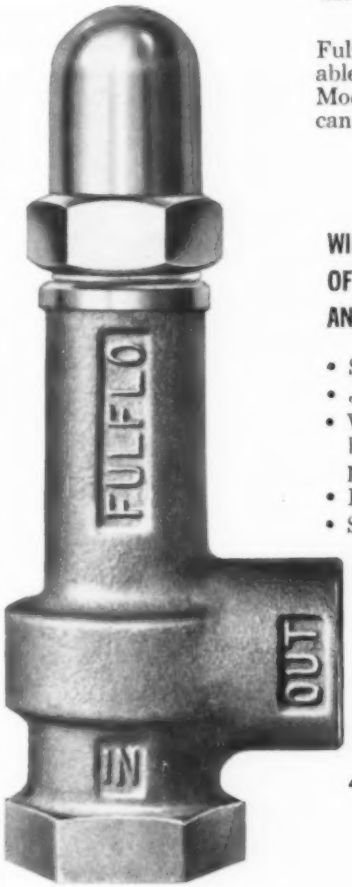
Best Buy because

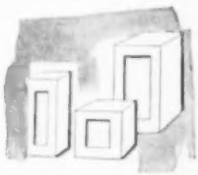
QUICK DELIVERY

Fulflo stocking policy *and* practice permits quick shipment from stock of most standard types. Shipment is usually made *within 24 hours.*

TECHNICAL SERVICE

Fulflo engineers are ready *and* able to help you with any valve problem. Modified standard or special valves can be provided for any need.





WIDE RANGE OF TYPES AND SIZES

- Standard and flanged models
- Just 6 springs for pressures to 500#
- Wide range of brass, cast iron or steel bodies . . . brass, steel or stainless pistons
- Pipe sizes to 3"
- SPECIALS to your requirements

Write for "Fulflo Valves Mechanical Data Book"

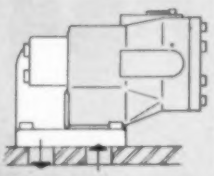
FULFLO

THE FULFLO SPECIALTIES CO., INC.
415 FANCY AVENUE • BLANCHESTER, OHIO

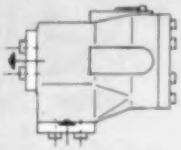
CIRCLE 42 ON READER SERVICE CARD

CIRCLE 85 ON TIME-SAVER CARD

PATENTS APPLIED FOR



White area indicates sub-plate mount. This mounting eliminates leaks, permits interchange of units of any capacity.



Standard SAE flanges (shown above in white) or threaded bodies are optional.

New Tell-Tale® Filters for 3000 psi Service are Sub-Plate Mounted

Now you can specify Rosaen Tell-Tale filters for use in pressure lines too! And as well as the Tell-Tale when-to-clean indicator, you get sub-plate mounting. This puts the filter on the control panel with the valves, makes it easy to check and service. For full-flow, 3000 psi service, the Tell-Tale pressure filter unit is available in four capacities: 10, 20, 30, and 60 gpm. As with the suction and return line Tell-Tale filters, filter cartridges are easily accessible for cleaning by removing the end plate. Write today for complete information.

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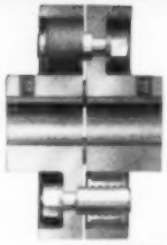
AJAX Patented Dihedral tooth shape handles angular and offset misalignment up to 12 degrees.



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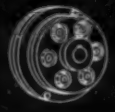
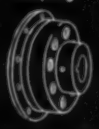
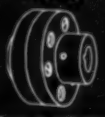


Ajax Type SP Shear Pin Coupling



Ajax Type BO Bolt-On Coupling



Ajax Type M Mill Motor Coupling

Ajax Type BD Brake Drum Coupling

POST SCRIPTS OF INDUSTRY

George A. Lagassa has been named vice-president-manufacturing of **Titeflex, Inc.**, Springfield, Mass. Lagassa was previously associated with the Elbeeco Division of Aeroquip Corp. **Gene P. Ross** has been appointed plant manager of the newly established Pacific Coast Division.

George A. Lagassa
Titeflex, Inc.

H. J. McBride
Parker-Hannifin

Parker-Hannifin Corp., Cleveland, Ohio, has appointed two new district managers of distributor sales for products of Parker Fittings and Hose Division and Parker Hydraulics Division. **H. J. McBride** will cover the territory of Maryland, Virginia, eastern Tennessee and the Carolinas from headquarters in Charlotte. From headquarters in Milwaukee, **W. E. Anderson** will cover Wisconsin and Minnesota.

American Engineering Company, Philadelphia, Pa., elected F. C. Messaros, vise president of engineering, as a director of the company.

The Hydrodyne Corporation, North Hollywood, Calif., appointed **D. V. Rowton** as vice president—sales. He was previously associated with Bendix Aviation Corporation's Pacific Division, specializing in hydraulic equipment and submarine control systems.

Automatic Switch Company, Florham Park, N. J., appointed **Mott Bros. Co.**, Rockford, Illinois as stocking distributors.

Appointment of **Leonard L. Krause** as controller of **Valvair Corp.** and the **Sinclair-Collins Valve Company** has been announced.

A new plant expansion of **Bendix Filter Division of Bendix Aviation Corporation's** main plant, at Madison Heights, Mich., will provide a fourteen percent increase in floor space for manufacturing. The major part of the added floor space will be devoted to the manufacture of Poroloy and Poromesh filters, which were previously manufactured at the Divisions' West Coast Branch.

Flodar Corporation, Cleveland, Ohio, named these two new distributors for its line of hydraulic tube fittings. **Marshall Equipment Co., Inc.,** Dorval Station, P. Q., Canada. It will have exclusive distributorship in the Province of Quebec and the Maritime Provinces. **The Neff Company,** Fort Wayne, Indiana, with branch offices in Indianapolis, South Bend and Evansville.

Leon B. Wohlgemuth was named general sales manager for the **Tubular Products Division of The Babcock and Wilcox Company.** Wohlgemuth was previously sales manager of middle states district sales offices.

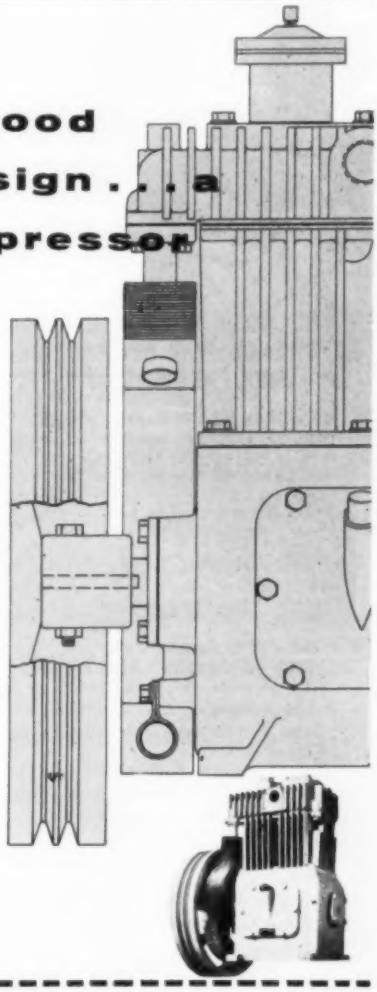
Leon B. Wohlgemuth Babcock & Wilcox

Alan J. Woodfield Sealol Corp.

Sealol Corporation, Providence, R. I., has promoted **Alan J. Woodfield** to executive vice president, **Justus B. Stevens** was named vice president in charge of the newly formed Seals and Accessories Group, and **Frank Bottomley** to vice president in charge of the new Tools and Equipment Group.

Mrs. Dorothy Rand, president, announced that construction has been started on the new manufacturing plant and office facilities of **Tomkins-Johnson Company,** Jackson, Mich. The new headquarters, located on a 13 acre site adjacent to Jackson will triple the facilities available at their present location. Operation in the new plant is scheduled for late 1958 or early 1959.

detail of a good machine design . . . a Quincy Compressor



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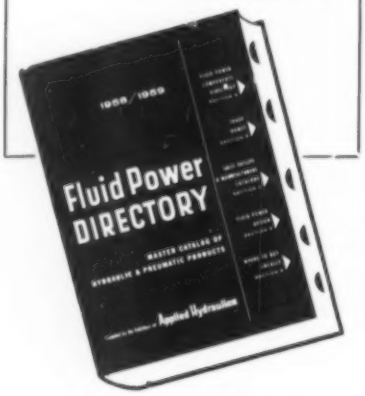

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Norman B. Dorries has joined the Portland, Oregon, office of the **Rucker Company.** Prior to his new position, Dorries headed the Portland office of Vickers, Inc.

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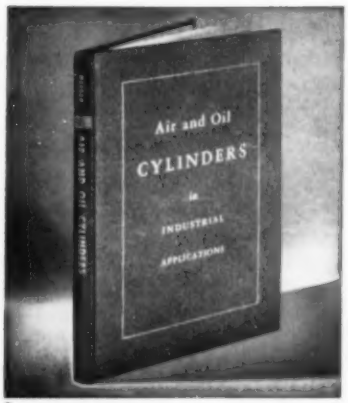

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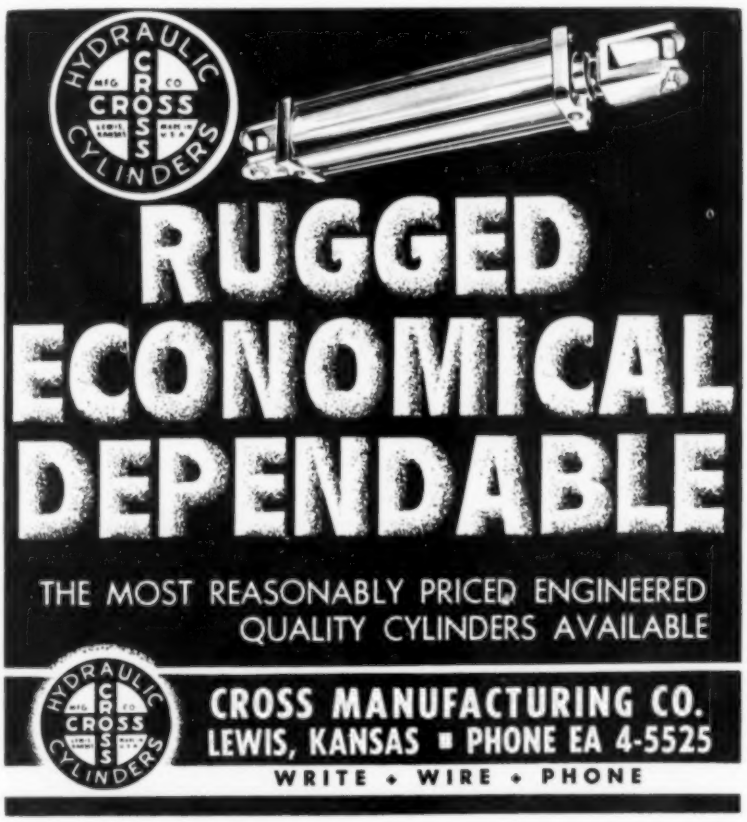

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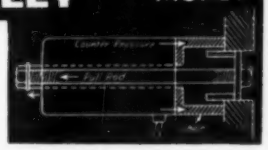

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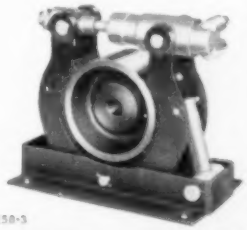

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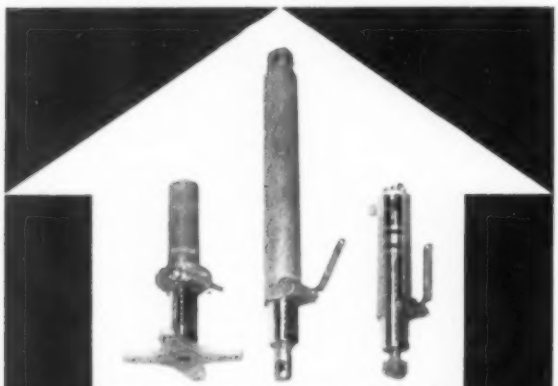

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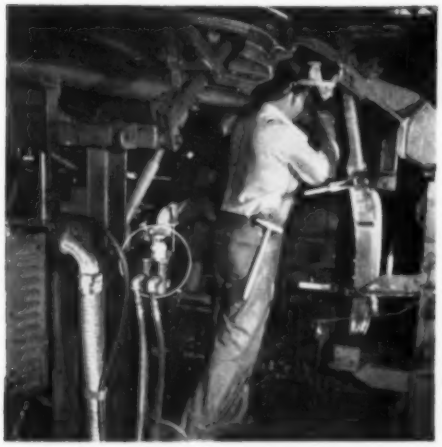

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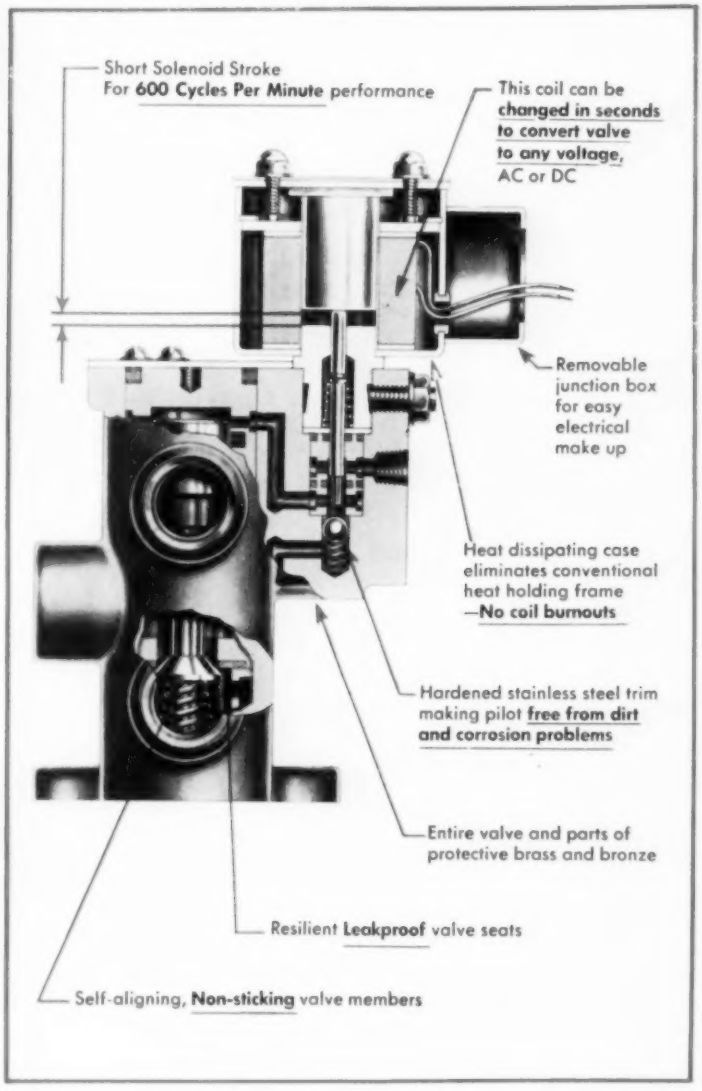
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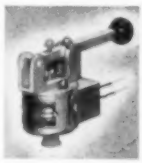
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